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DEPARTMENT OF THE ARMY FIELD MANUAL

(only 1 copy)

**ARMY AVIATION
AIR TRAFFIC OPERATIONS
TACTICAL**

S/S 10068



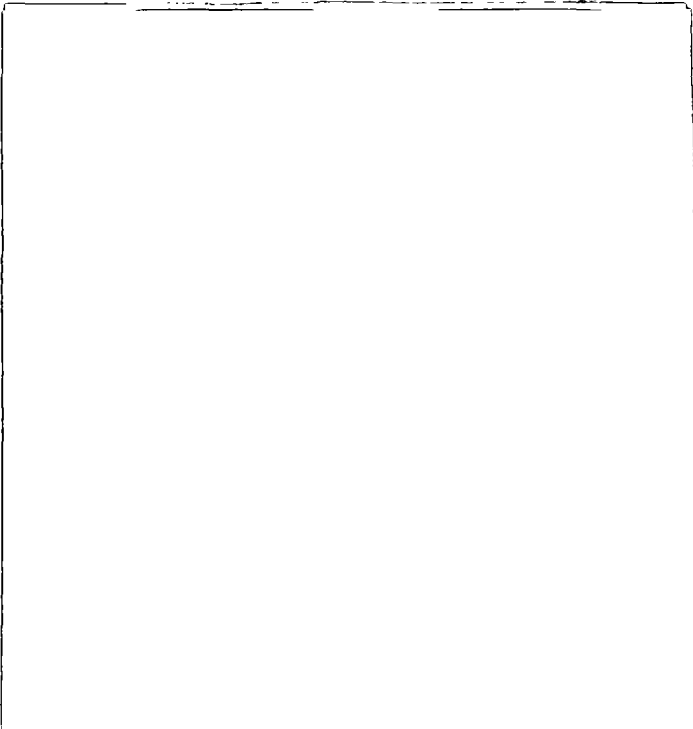
HEADQUARTERS, DEPARTMENT OF THE ARMY

AUGUST 1960

FORWARD

The communication and navigation equipment described in this manual is of transitional nature. Future equipment, such as hyperbolic navigation systems, self-contained navigation devices, terrain avoidance and air traffic viewers, IFF, and multiple-channel radios (light and small, long-range, and non-line-of-sight) will be integrated into the Army traffic system as it becomes available.

Although this manual places primary emphasis on air traffic regulation measures and navigational requirements, the Army's concept of present and future air traffic tactical operations is based upon freedom of action and minimum regulation. This manual should not be construed to restrict this concept. Ultimately, control should be limited to that necessary for command purposes. With the improved equipment above, aircraft will be able to navigate with little or no aid from the ground, pilots will be able to maintain their own separation under all visibility conditions, and identification will be automatic.



FIELD MANUAL }
No. 1-60

HEADQUARTERS,
DEPARTMENT OF THE ARMY
WASHINGTON 25, D. C., 24 August, 1960

ARMY AVIATION AIR TRAFFIC OPERATIONS—TACTICAL

	Paragraphs	Page
CHAPTER 1. GENERAL		
Section I. Purpose and scope.....	1, 2	3
II. Command and staff responsibilities and unit functions.....	3-5	3
CHAPTER 2. THE ARMY AIR TRAFFIC REGULATION AND IDENTIFICATION SYSTEM		
Section I. Traffic regulation measures.....	6-8	6
II. Air traffic regulation and identification forward of division base airfields.....	9-11	10
III. Flight plans, changes, and reports.....	12-14	13
IV. Air route separation criteria and altitude assignment.....	15, 16	18
V. Terminal traffic control.....	17-19	20
VI. Traffic regulation procedures.....	20-27	23
VII. Allocation of regulation responsibility.....	28, 29	30
VIII. Identification and air defense operations.....	30-32	32
CHAPTER 3. NAVIGATION METHODS		
Section I. Air navigation principles.....	33-36	35
II. Supplementary navigation facilities.....	37-39	38
CHAPTER 4. COMMUNICATIONS		
Section I. General.....	40-42	40
II. Army air traffic tactical communications.....	43-45	41
III. Communication security.....	46, 47	44
CHAPTER 5. WEATHER SERVICE SUPPORT		
Section I. General.....	48-50	45
II. Weather information.....	51, 52	47
CHAPTER 6. THE AIR TRAFFIC REGULATION AND IDENTIFICATION SYSTEM (ARMY)		
Section I. Mission and capabilities.....	53-56	50
II. Reconnaissance, selection, and occupation of position (RSOP).....	57-60	51
III. Organization of the airfield.....	61-64	52
IV. Airfield air traffic operations.....	65-69	56
V. Flight operations center (FOC)—general.....	70-72	59
VI. FOC equipment requirements and applications.....	73-79	61
VII. Location, physical arrangement, and displacement.....	80, 81	69
VIII. Operating techniques.....	82-92	72
IX. FOC communications.....	93-96	77

*This manual together with ACP 150A, 30 April 1952, and ACP 151A, 30 April 1952, supersedes TCM 6, 2 October 1956.

	Page
APPENDIX I. REFERENCES.....	80
II. METHOD OF DISSEMINATING FLIGHT INFORMATION.....	81
III. OPERATIONAL CODES.....	86
IV. MAJOR ELECTRONIC EQUIPMENT.....	89
V. FIELD ARMY TACTICAL AIR TRAFFIC REGULATION PROCEDURES (FOC AND AIRFIELDS).....	98
GLOSSARY.....	120

CHAPTER 1

GENERAL

Section I. PURPOSE AND SCOPE

1. Purpose

This field manual is a guide for commanders, staff officers, and other individuals concerned with Army air traffic tactical operations. It provides guidance for the Army air traffic regulation and identification system.

2. Scope

a. The scope of this manual includes—

- (1) Command and staff responsibilities for Army air traffic regulation and the navigation system.
- (2) Army air traffic regulation measures and procedures.
- (3) Identification and air defense measures and procedures.
- (4) The employment, capabilities, and limitations of navigation and communication equipment.
- (5) The functions of the Army air traffic regulation and identification (AATR&I) system.

b. The material presented herein is applicable without modification to both nuclear and nonnuclear warfare. Pertinent manuals and other military publications are listed in appendix I. A glossary of special terms is included for convenience of reference.

c. Users of this manual are encouraged to submit recommended changes or comments to improve the manual. Comments should be keyed to the specific page, paragraph, and line of the text in which change is recommended. Reasons should be provided for each comment to insure understanding and complete evaluation. Comments should be forwarded direct to U.S. Army Aviation School.

Section II. COMMAND AND STAFF RESPONSIBILITIES AND UNIT FUNCTIONS

3. General

a. The theater commander (a unified commander) establishes policies and procedures for regulation of air traffic within the theater (area) of operations. The field army commander is responsible for the regulation of Army air traffic over his area of responsibility. The field army commander's responsibility is exercised within the authority, policies and procedures prescribed by the

theater commander or agreed to by the Service component commanders or by the Service element commanders concerned. The field army commander is responsible also for coordination of the use of the air space over his area of responsibility by all Services to the extent authorized or directed by the theater commander or agreed to by the Service component commanders or by the Service element commanders concerned. Regulation of the air traffic of the other Services is the responsibility of each Service concerned. Coordination of the use of the air space over the Communications Zone is the responsibility of the commander so designated by the theater commander. The commanders of the logistic commands located within the Communications Zone are responsible for the regulation of Army air traffic within their geographical areas of responsibility.

b. The Army air traffic regulation and identification system in the combat zone is organized to parallel the command structure of the field army.

c. The Army air traffic regulation and identification system is established to coordinate and expedite the safe and orderly flow of Army air traffic under all flight conditions, facilitate air defense operations, and provide inflight assistance to Army aircraft.

4. Command and Staff Responsibilities

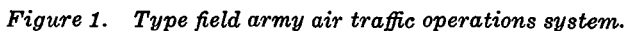
a. Staff supervision is exercised by the Army aviation staff officer at each level of command. He normally carries out this supervision through the aviation element in the tactical operations center where one exists. The Army air traffic regulation system must maintain liaison with the Army air defense system. The Army aviation staff officer at each echelon of command will insure that such liaison is maintained.

b. The Army air traffic regulation system operates under the staff supervision of the Army aviation staff officer at the level to which elements of the system are attached or assigned. Normally, one FOC and an alternate at reduced strength will be assigned to each field army and corps. Flight Coordination Centers (FCC) may be used to extend the FOC capability into high density air traffic areas forward of corps FOCs. FOCs will be colocated with Air Defense Command Posts (AADCP) at army and corps, and with Air Force Control and Reporting Centers (CRC) in the army service area. Control towers are organic to aviation units at the various echelons.

5. Unit Functions

a. FOC's (FCC's) and airfield control towers are the basic elements of the Army air traffic regulation and navigation system.

b. A base airfield with its allied navigational aids will provide the basic navigational system (fig. 1) to facilitate the regulation of Army air traffic. This will be a beacon-to-beacon system with nonsimultaneous surveillance and ground control approach (GCA) radar available at the field army, corps, division, and other major airfields. Under instrument flight rules (IFR), Army aircraft will navigate with the aid of the nondirectional beacons and radar **vectoring**.



CHAPTER 2

THE ARMY AIR TRAFFIC REGULATION AND IDENTIFICATION SYSTEM

Section I. TRAFFIC REGULATION MEASURES

6. General

a. The Army air traffic regulation and identification system is established to—

- (1) Coordinate and expedite the safe and orderly flow of Army air traffic.
- (2) Facilitate Army air defense operations.
- (3) Provide air warning and inflight assistance to aircraft using the system.
- (4) Coordinate Army air traffic with the other Services.

b. The flight operations center has primary responsibility for operating the Army air traffic regulation system. FOC's are established in each corps area, field army service area and, when required, in the Communications Zone. FOC's effect Army air traffic regulation in the commander's area of responsibility, coordinating as appropriate with the associated AADCP and at field army level, the associated tactical Air Force Control and Reporting Center. FOC's will be located adjacent to designated AADCP's in the corps and the field army areas. All FOC's have a designated area of responsibility which approximately coincides with the AADCP area of responsibility. Local regulation of air traffic is exercised in airfield control zones. Figures 2 and 3 show the FOC area of responsibility and relationships within corps and field army areas. Coordination with other services is effected with the tactical Air Force Control and Reporting Centers (figs. 2 and 3). Regulation of Army air traffic between one field army area and another field army area will be accomplished by coordination between the field army FOC's concerned. Coordination of field army aviation operations requiring use of the air space over another field army area will be effected between the field armies concerned. Coordination pertaining to current field army aviation operations is effected normally between the Tactical Operations Centers of the field armies concerned. Regulation of Army air traffic between a field army area and the Communication Zone is accomplished by coordination between the field army FOC and the Communication Zone FOC, if the latter is established. In the event a Communica-

tions Zone FOC is not established, this coordination is effected between the field army FOC and the responsible tactical Air Force Control and Reporting Center through the tactical Air Force Control and Reporting Center in the field army area.

7. Air Traffic Rules

a. The three types of air traffic rules prescribed for the Army air traffic regulation and identification system are general flight rules, visual flight rules (VFR), and instrument flight rules (IFR). Army aviators will at all times comply with general flight rules in addition to either VFR's or IFR's. The appropriate commander will establish and promulgate uniform tactical flight rules within his area of operations.

b. Aircraft operations at night within the combat zone will be governed by flight rules established by the appropriate commander and, normally, aircraft forward of the established "light line" will be flown without lights. Aircraft operating to the rear of the "light line" will, when practical, display navigation lights to aid in traffic separation.

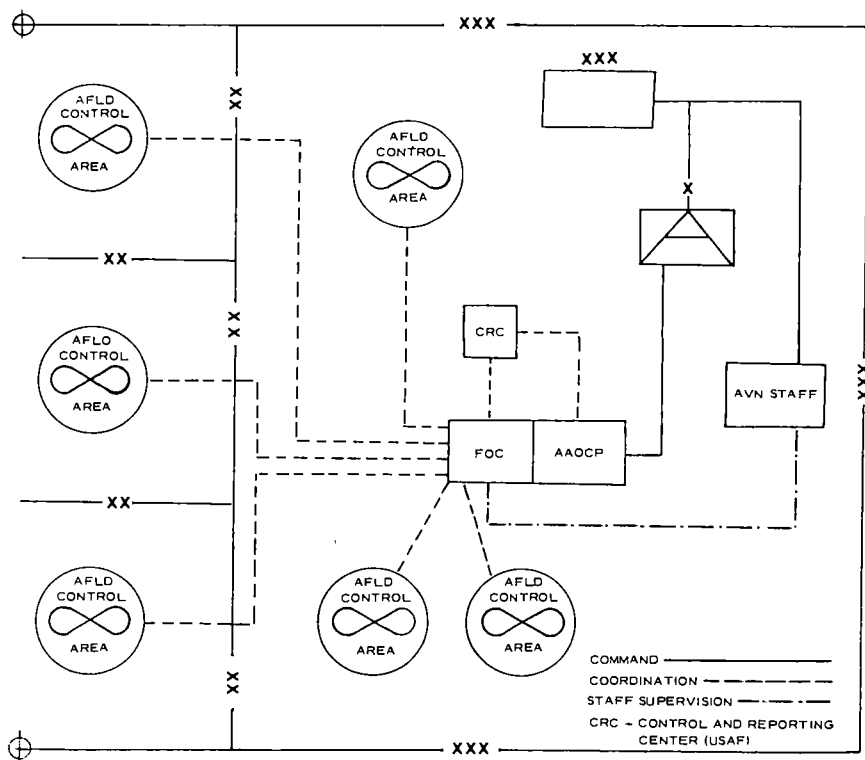


Figure 2. Corps FOC area of responsibility and command relationship.

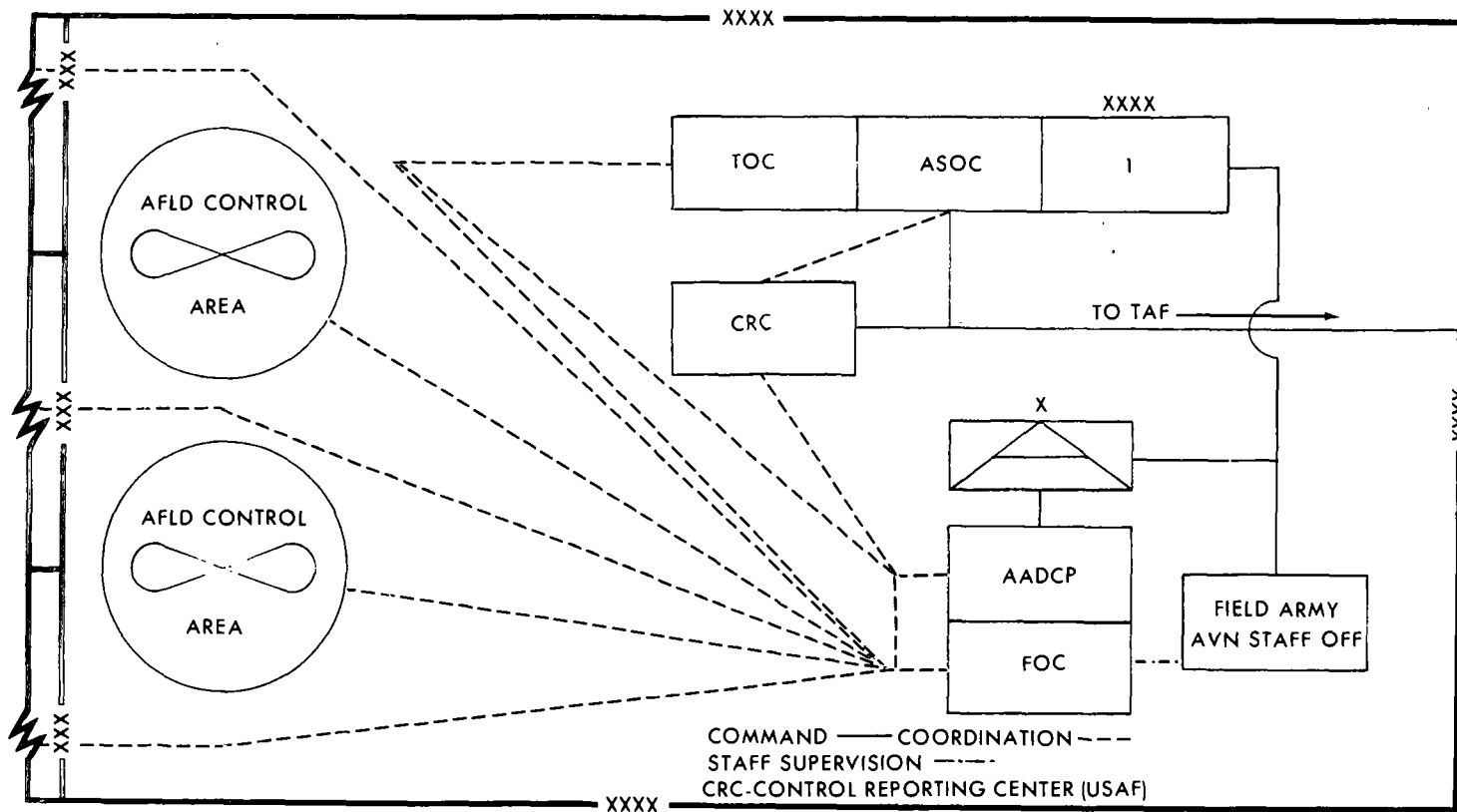


Figure 3. Field army FOC area of responsibility and command relationship.

8. Types of Traffic Regulation

Four general types of traffic regulation utilized by Army aviation in the combat zone are *forward area regulation*, *route regulation*, *point-to-point regulation*, and *airfield (control zone) control* (fig. 1).

a. *Forward Area Regulation*. See paragraph 9.

b. *Route Regulation*. Regulates Army air traffic to the rear of division base airfields and may, during major air operations or when required for air defense, regulate Army air traffic forward of division base airfields (pars. 9-11). Traffic is separated by altitude and time.

(1) *Primary Army air routes*. Consisting of common routes of Army air travel, primary Army air routes are established between nondirectional beacons located at airfields of major echelons to include division base airfields. The beacons facilitate the flow of air traffic between echelons. Primary Army air routes are established by the Army commander.

(a) *Dimensions*. Air routes are based on bearings of LMF beacons, normally no more than 50 miles apart, and are established to avoid hazardous terrain obstacles and critical air defense areas. Air routes 25 miles or less between beacons are 5 miles in width; i.e., $2\frac{1}{2}$ miles each side of the center line. Routes more than 25 miles between beacons are 10 miles in width; i.e., 5 miles each side of the center line. Air route radio beacons constitute compulsory IFR traffic regulation reporting points.

(b) *Fixed wing operating altitudes*. Minimum altitudes for IFR operation of fixed wing aircraft are normally based upon a standard 1,000 feet above the highest obstacle on each air route. The shortest flights are usually assigned the lower altitudes immediately above those used by rotary wing aircraft.

(c) *Rotary wing operating altitudes*. Rotary wing aircraft operations normally receive lower altitude priority and the aircraft may be flown below air route minimum altitudes when under *contact flight conditions* (visual reference with the ground).

(2) *Special and secondary air routes*. Special air routes may be established for short-time operation of large numbers of aircraft (e.g., Army transport aviation units) and for surveillance aircraft and drone flights from rear to forward areas. Regulation of traffic on special air routes may be delegated to the commander of the aviation unit

which utilizes the route, provided no conflict with other air traffic will result. Secondary air routes supplementary to primary Army air routes may be established as required by corps commanders.

c. Point-to-Point Regulation. Point-to-point flights are IFR flights off air routes in rear of division areas. They may be conducted as straight-line flights between beacons, or they may utilize an outbound track to intercept an inbound bearing of a different beacon. Point-to-point regulation of these flights requires air route regulation procedures such as flight plans and position reports. Within air defense surveillance radar capability the AADCP may provide the FOC continuous information on the location of Army aircraft operating in the field army area outside established air routes. Regulation of these flights is the responsibility of the FOC.

d. Airfield (Control Zone) Control. A traffic control zone is established for each major Army airfield in the combat zone to include the field army base airfield, corps base airfields, division base airfields, and other designated airfields. Control zones normally consist of a designated area surrounding both the airfield and LMF beacon and extending from the surface upward to a designated altitude. These airfields maintain radio control of air traffic within their zones at all times. The aviation officer responsible for the airfield will prepare and submit for approval to field army headquarters (through traffic control channels) pertinent traffic patterns, instrument holding patterns, instrument letdown procedures, and IFR minimums peculiar to the particular airfield.

Section II. AIR TRAFFIC REGULATION AND IDENTIFICATION FORWARD OF DIVISION BASE AIRFIELDS

9. Forward Area Regulation

For clarity in discussing Army air traffic regulation in the field army, the field army area is divided into three subareas, namely: *Subarea 1* forward of the FEBA to the maximum effective range of Army air defense missiles; *Subarea 2* between the FEBA and the division rear boundary; and *Subarea 3* between the division rear boundary and the field army rear boundary (this area may extend into the communications zone when necessary).

a. Definition. Forward area regulation is that area of Army air traffic regulation encompassed in Subareas 1 and 2 of the field army area.

b. Identification. A primary purpose of forward area air traffic regulation is to identify aircraft to air defense units when the

airspace over the forward area is effectively covered by radar controlled antiaircraft weapons.

c. Means.

- (1) Identification of aircraft in the forward area (fig. 4) is accomplished by use of coordinates to define areas of operation by prescribing boundaries and assigning code names. This system, designed for aircraft operations in Subarea 2, may be extended into Subarea 1 when operational requirements dictate.
- (2) For concerted air movements in the forward area, pre-planning by commanders must include complete coordination with FOC and air defense agencies to include forward air defense units. See also FM 1-100 and FM 57-35.
- (3) Flights originating in Subarea 3 and operating in the forward area will transmit flight plans to the FOC controlling their area of operation. The FOC, in turn, will forward pertinent information to the AADCP. The air defense intelligence service, using radar and visual means, will continuously track (within radar capabilities) all flights outside established air corridors. It is

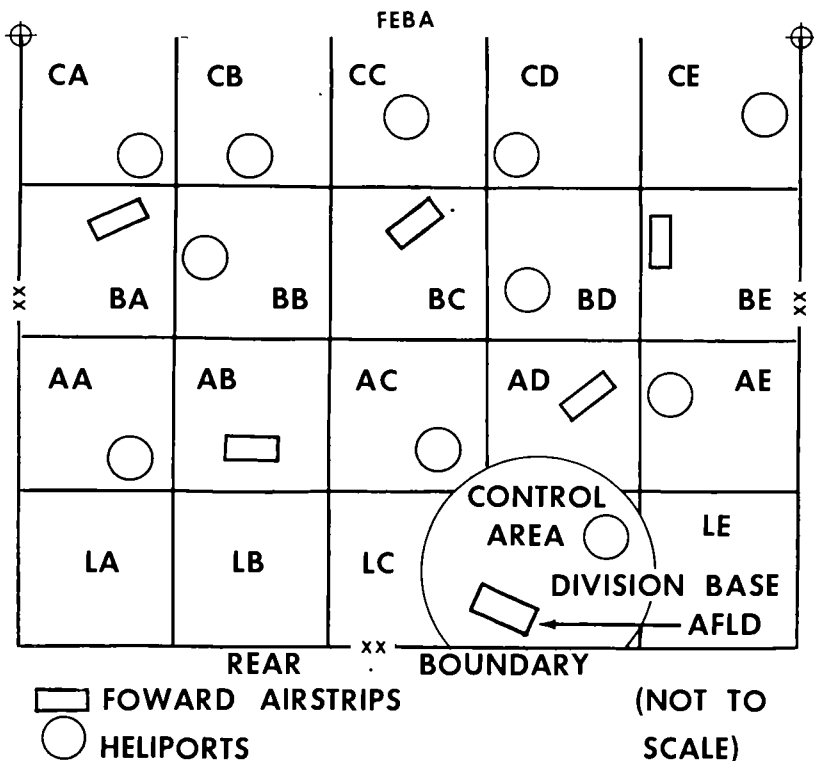


Figure 4. Aircraft identification system in the forward area.

the responsibility of the force air defense commander to make this position information available to the FOC in such a manner as to best facilitate air traffic regulation in the forward area.

- (4) Individual Army aircraft operations within Subarea 2 will require filing of a simplified flight plan (par. 12b) with the appropriate base airfield having communication with FOC. Air defense intelligence service ((3) above) is thereby made aware of the friendly character of the flight.
- (5) All Army aircraft operating within Subarea 1 will file a simplified flight plan. Subarea 1 reconnaissance type air operations characterized by minimum altitudes to avoid radar detection and by diversity of movement and location to accomplish assigned missions may require airborne radio relay facilities as an intermediary communication link. In this way, the reconnaissance information obtained is transmitted rapidly to the appropriate commander. This procedure provides the commander a means of directing the reconnaissance effort and of keeping FOC informed of the location and identity of the aircraft involved.

10. Tracking Friendly Aircraft

Friendly aircraft operating along the FEBA are continuously tracked by air defense radars and visual observers. In addition, GCA radars at division base airfields and the tracking and plotting radars located in division forward areas may be used to make additional checks as desired.

11. Drone Operations

The primary mission assigned to drones in the field army is combat intelligence.

a. Combat Intelligence Missions. Combat intelligence missions require that drones operate from the forward sector into enemy territory to the limit of the army area of interest. These drones will be regulated by both programmed flight and tracking and plotting radar ground control. Drones operating in the division area of interest will be controlled primarily by radar while those operating to greater depths will rely on programmed flight.

b. Employment. Surveillance drones will normally be launched from locations as far forward as feasible and will utilize direct flight paths off prescribed air routes (where possible) in reaching their assigned areas of operation. For those launched in rear areas, the flight forward will normally be at higher altitudes than other aircraft in the system, with letdown to operating altitudes

accomplished at prearranged points acceptable to other users and approved through the FOC. Approval through the FOC will be required for all drone flights so that appropriate information can be forwarded to other aircraft flying in the affected areas. Flights through Subarea 2 will be coordinated so that interference will be reduced to a minimum for aircraft normally operating in this area. Implementation of the Scat plan (*see* Glossary) will, under most conditions, provide sufficient warning for these aircraft.

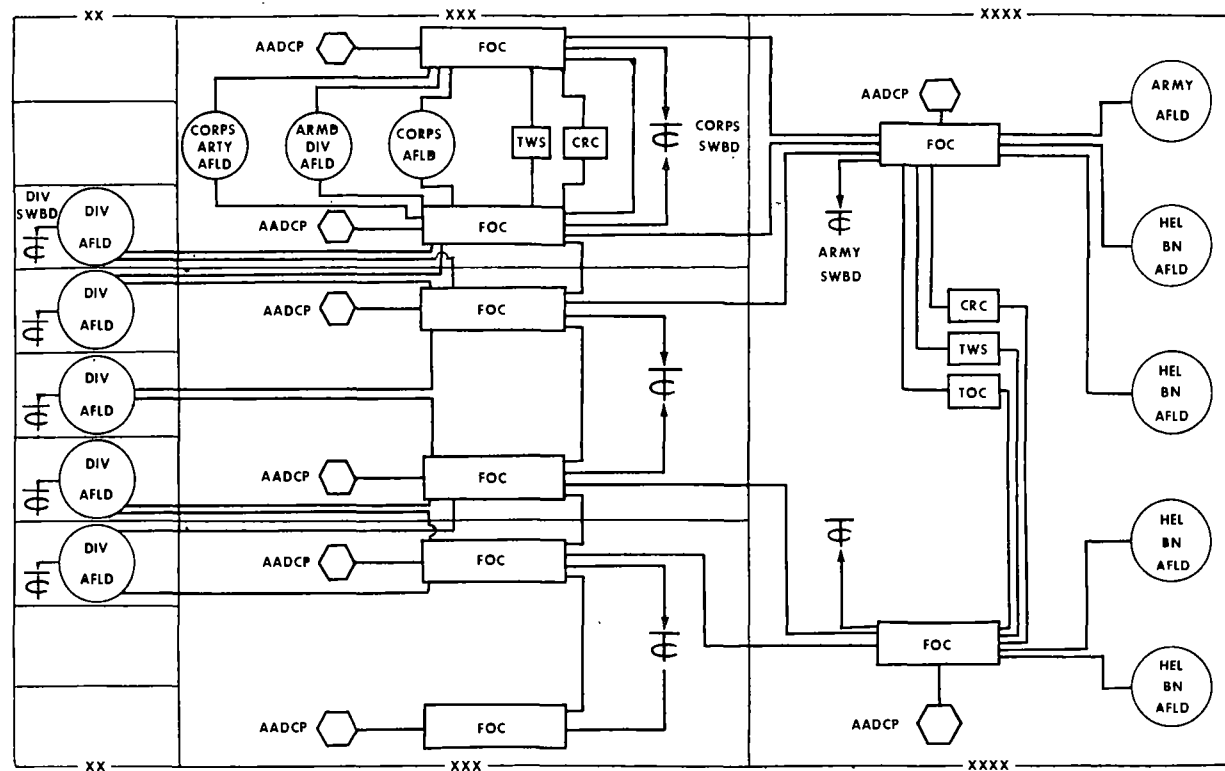
Section III. FLIGHT PLANS, CHANGES, AND REPORTS

12. Flight Plans

a. Army aircraft flight plans are *submitted* to appropriate flight operations centers for all flights. The aviation staff officer at each echelon concerned with the operation of Army aircraft is responsible for forwarding to the appropriate FOC the flight plans of organic, attached, and transient aircraft within his jurisdiction. Flight plans are submitted to the FOC by one of the following methods:

- (1) Flight plans, flight schedules, and/or preplanned missions are normally submitted to the appropriate FOC by telephone (fig. 5). FOC clearance and instructions are transmitted by the same means. When telephone communication is unavailable, flight plans may be submitted by teletype (fig. 6).
- (2) Flight plans for immediate flights, or when ground-to-ground (telephone or teletypewriter) communications are unavailable, are transmitted by the aircraft directly by radio to the FOC via the air traffic regulation channel immediately after takeoff (fig. 7). Normally, instrument flight plans will not be submitted in this manner. Flights under these conditions maintain contact within control zones of takeoff airfields until clearance and traffic instructions are issued by FOC. Under no circumstances will en route IFR flights be conducted prior to clearance from the appropriate FOC.

b. The form below is followed in filing flight plans. Only information pertinent to the specific flight is submitted. For individual flights under VFR, a simplified flight plan (items below marked by asterisk) will be filed (par. 9c(4)). Appropriate prearranged codes for brevity and security will be prescribed for filing plans by radio (app. III). Radio communication pertaining to flight plans will always be authenticated. Local theater regulations may permit elimination of certain elements of the flight plan for the sake of brevity when standard data can be applied at the FOC.



CRC- CONTROL AND REPORTING CENTER (USAF)

TWS- TACTICAL WEATHER SERVICE (USAF)

Figure 5. Type interphone net for air traffic regulation.

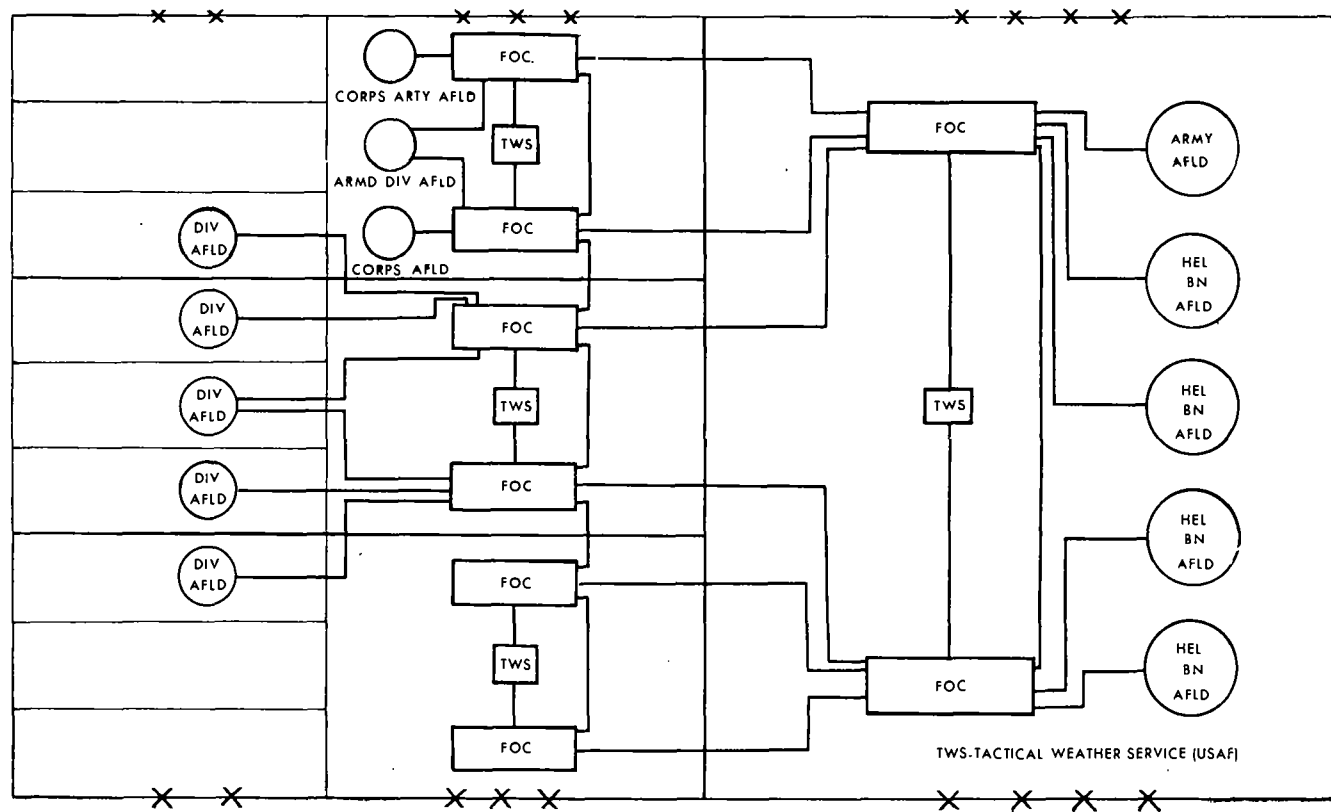
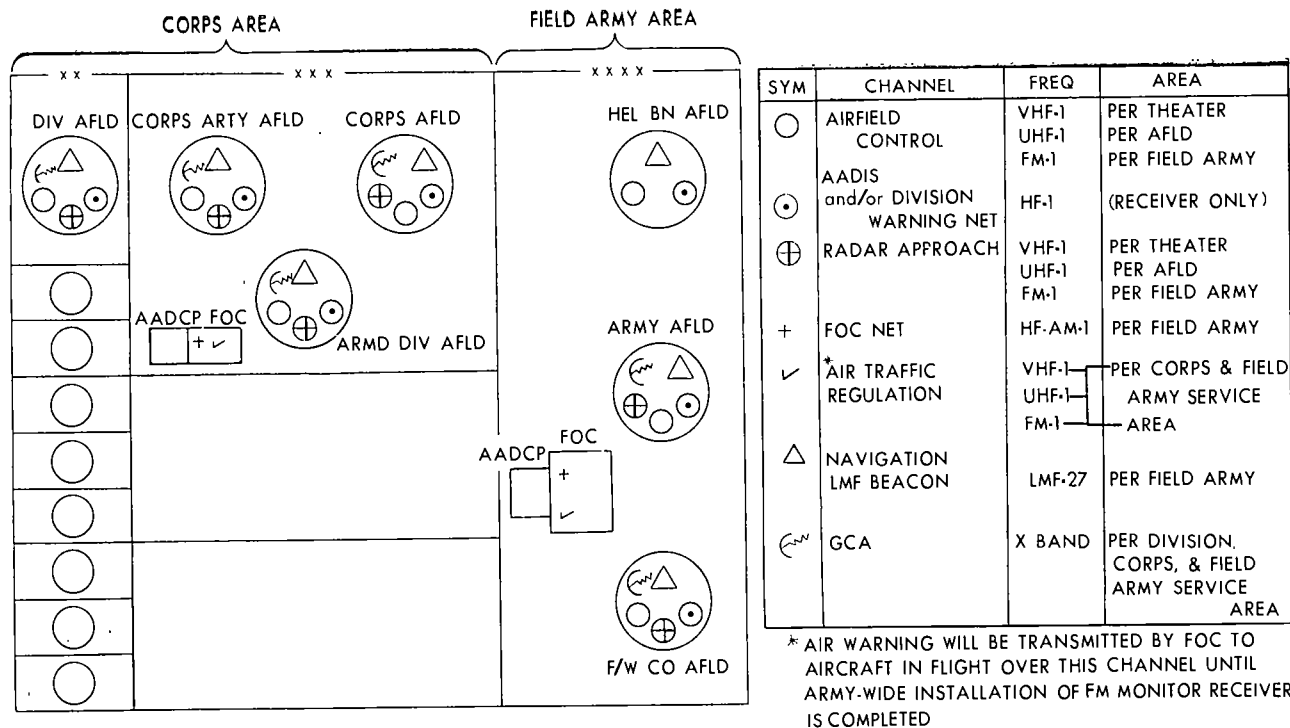


Figure 6. Type teletypewriter net for air traffic.



NOTE: VHF AND UHF BOTH WILL NOT BE REQUIRED WHEN ALL AIRCRAFT IN THE THEATER ARE EQUIPPED TO OPERATE IN THE UHF BAND

Figure 7. Radio and navigation facilities.

- * (1) Tactical call sign of aircraft.
- * (2) Aircraft type.
 - (3) Type radio available (VHF-UHF or FM).
 - (4) Number of aircraft (for formations).
- * (5) Point of departure.
- * (6) Route (or area of operation).
- * (7) Destination.
 - (8) Altitude requested.
 - (9) Flight condition (IFR or VFR).
- * (10) Estimated time en route or airborne.
 - (11) True airspeed.
 - (12) Alternate airfield.
 - (13) Fuel on board in hours.
 - (14) Other information.

13. Inflight Changes to Flight Plans

Changes in flight plans of airborne Army aircraft operating under instrument flight rules are submitted for approval by radio to the FOC in whose area the aircraft is operating. Changes in flight plans of airborne army aircraft under VFR are reported to the FOC for information before course is altered or as soon thereafter as possible. If there is a communication difficulty, a nearby airfield may be used to relay changes to the pertinent FOC.

14. Position Reports

a. Position reports are required by FOC at least once each hour from all flights operating within Subarea 3 (par. 9). In addition, reports are required when specifically requested by FOC, and from aircraft operating under IFR upon their arrival over designated compulsory reporting points.

b. The following information is included in an IFR position report. Items marked with an asterisk are also transmitted in a VFR position report.

- * (1) Tactical call sign of aircraft.
- * (2) Position (code).
- * (3) Time over position reported.
- * (4) Indicated altitude (code).
- (5) Type of flight plan.
- (6) Estimated time over next reporting point (code).
- (7) Name of subsequent reporting point (code). If next reporting point is destination, repeat name (code).

Section IV. AIR ROUTE SEPARATION CRITERIA AND ALTITUDE ASSIGNMENT

15. Separation Criteria

a. General. Separation of air traffic is required for aircraft operating in instrument conditions or at night in area forward of the light line, and is accomplished primarily by longitudinal and altitude methods with the possibility of combining lateral separation with either of these primary means. No separation standard is required for en route traffic above a well-defined top of a cloud, or other formation, if frequent pilot reports indicate a vertical clearance of 500 feet from clouds and a forward visibility of at least 3 miles. Separation standards are not required for aircraft holding under these conditions during daylight hours.

b. Longitudinal Separation.

- (1) Aircraft flying at the same altitude are kept a minimum distance apart by longitudinal separation. If aircraft are at the same altitude on the same course and radio facilities permit frequent checks of position and speed, time separation should be approximately 5 minutes. If frequent checks are not possible (beacons more than 25 miles apart), time separation should be approximately 10 minutes. If aircraft are on crossing courses at the same altitude, they should be separated by approximately 5 minutes. The foregoing separations are given as a guide only and may be altered as dictated by the situation. When large numbers of one type aircraft use an air route, assignment of arbitrary altitudes and a standard cruising speed for that type may shorten the longitudinal separation time. FOC's will set appropriate time spacing by taking into account aircraft speeds, traffic density, and local conditions.
- (2) When aircraft traveling in the same direction at different altitudes are not provided with lateral separation and where one aircraft will pass through the altitude of another, separation must be at least 5 minutes at the time altitude levels are crossed. This minimum time separation applies only when a leading aircraft will descend through the altitude of a following aircraft, or a following aircraft will climb through the altitude of a leading aircraft. The climb or descent must be started within 10 minutes after the time the lower aircraft has reported over a reporting point.
- (3) If aircraft traveling in opposite directions at different altitudes are not separated laterally, a climb by the air-

craft at lower altitude or a descent by the aircraft at higher altitude will be avoided within 5 minutes of the estimated time at which they will pass. This minimum does not apply if reports are received that they have actually passed each other.

- (4) To effect longitudinal separation, aircraft may be required to depart at a specified time, or to lose time while en route in order to arrive over a navigational fix at a specified time, or to hold at a beacon until a specified time. In emergencies, the aircraft may have to reverse course.

c. Altitude Separation. Wherever there is need for altitude separation, aircraft must be separated vertically by at least 500 feet.

d. Lateral Separation. Lateral separation is generally employed in combination with other types of separation and is rarely employed as the sole type of separation. Two principal types of lateral separation are as follows:

- (1) *Quadrant separation.* Traffic in different quadrants or sectors of the same radio navigational facility.
- (2) *Geographic separation.* Aircraft positively indicated as separated by position reports over different geographical locations as determined visually or by reference to a radio navigational facility.

16. Altitude Assignment

a. General. The safe movement of air traffic requires that flight operations centers make definite altitude assignments. These assignments must consider weather, landing sequence, priority of flight, and other pertinent flight problems.

b. Priority. This refers to the right of one aircraft to occupy an altitude to the exclusion of other aircraft. In general, an aircraft occupying a certain altitude is considered as having priority to that altitude over all aircraft desiring the same altitude. When two or more aircraft are flying at the same altitude, the first aircraft normally has priority over the aircraft following. In practice, a flight operations center assigns aircraft to a vacant altitude when the aircraft last assigned to this altitude definitely reports that it has left this altitude. However, when severe turbulence exists, there must be no assignment until the first aircraft has reported at another level. Furthermore, whenever a controller finds it necessary, he may advise the pilot to change altitude at a specified time or place.

c. Approach Sequence. Cruising altitudes of aircraft flying to the same destination are assigned in a manner that will be correct

for an approach sequence at the destination. That is, the aircraft to arrive first is assigned the lowest altitude, the aircraft to arrive second, the next higher altitude, and so on, with the last aircraft in sequence at the highest altitude level. If departures are delayed to avoid excessive holding at destination, these flights should be cleared in the order in which the flight plans are filed or by priority set by proper authority.

d. Ontop Altitudes. When conditions permit forward visibility of at least 3 miles and vertical clearance of 500 feet from clouds, aircraft may be assigned to fly "on top." The upper surface of clouds, haze, smoke, etc., is known as a *top*, and assignment above the top is spoken of as "ontop." Before assigning such an altitude, FOC must know that a definite top exists and must advise the pilot of its height when giving instructions for flying on top.

e. Altitude Changes in Flight Plan. When a pilot requests a change of altitude in his flight plan, the FOC transmits the exact nature of the change, preceded by the word "cleared." If an altitude change is requested, and more than one is contained in the flight plan, all of these altitudes are given in the approval. For example, approval of the request for the altitude change would read, "Cleared to maintain 5,000. Cross A at 2,000, cross B at 3,000, cross C at 4,000." If traffic conditions prevent FOC approval of a flight plan or request for a change in a flight plan, the FOC will reply "Unable to approve," and will transmit, if possible, a suggested revised plan for acceptance by the pilot.

Section V. TERMINAL TRAFFIC CONTROL

17. Responsibilities

a. Terminal traffic control is exercised from an airfield tower located at each major airfield. The tower controls airfield traffic by issuing clearances and other pertinent information to facilitate aircraft movement to, upon, from, and above the landing area, preventing collision between—

- (1) Aircraft operating on the ground at the landing area.
- (2) Aircraft and vehicles operating on the landing area.
- (3) Aircraft in the traffic pattern, and those landing and taking off at the landing area.
- (4) Aircraft operating under instrument flight conditions after control of such aircraft has been passed to the tower by appropriate FOC.

b. When flying VFR, the pilot is directly responsible for avoiding collision with other aircraft, but he is aided to the fullest extent by information and clearances issued by the control tower. When flying under instrument flight conditions, the pilot cannot

assume responsibility for avoiding collision with other aircraft, except as directed by the ground control agency. Therefore, it is of the utmost importance that all clearances issued by a control tower to aircraft under its jurisdiction be adequate, concise, and definite.

c. Requests for authorization of departure from or entry into a terminal control zone will be handled individually. In each case, adequate separation will be effected by terminal control between such operations and all IFR traffic, as well as other operations of the same nature.

18. Departures

In addition to the separation minimums previously specified, departures under instrument conditions may require further control. Definite instructions must be issued regarding direction of takeoff, turn after takeoff, track to be made good before proceeding on the desired course, altitude to maintain before continuing climb to assigned altitude, time or point at which an altitude change shall be made, or any necessary maneuver consistent with safe operation of an aircraft. However, in order to provide an orderly flow of traffic, the tower will make every effort to guide departing aircraft on course with as few turns or other maneuvers as possible and to cruising altitude with few restrictions. The pilot must be notified of a delay to his departure as soon as possible to avoid holding the aircraft on the airfield with the engine running for extended periods of time.

a. If a departing aircraft proposes to fly the same course as a preceding aircraft and fly through the altitude level of the preceding aircraft, the tower will assure a 5-minute separation between these aircraft and will maintain or increase this separation when altitude levels cross.

b. If aircraft are to fly different courses with lateral separation immediately after takeoff, 1-minute separation will be the minimum. This minimum may only be reduced when aircraft are authorized to use parallel runways.

c. The tower may expedite departures by recommending a take-off direction when wind velocity does not exceed 10 miles per hour. The pilot will decide whether to follow this recommendation or wait to take off in a preferred direction.

d. If the weather permits, the pilot may be instructed to depart and remain VFR until a certain time or until reaching a certain location.

e. To expedite traffic, inbound aircraft may be instructed to report to the tower when leaving or passing a known location or the LMF beacon or starting a procedure turn on final approach, or to report other information required.

f. When takeoff clearance is based on the position of an arrival, the following procedures will apply:

- (1) If the arrival is to make a complete instrument approach (initial and final), departing aircraft may (before the arrival has started the procedure turn on final approach) take off in any direction if an immediate turn to avoid collision course with inbound aircraft is feasible; or may take off in a direction greater than 45° from the arrival's approach course after the arrival has started the procedure turn, provided the takeoff will be made at least 3 minutes before the arrival is estimated over the airport. Takeoff will *not* be authorized when the arrival is less than 3 minutes from the airport.
- (2) If the arrival will make a straight-in final approach, a departing aircraft may take off in any direction until 5 minutes before the arrival is estimated over the airport. Unless altitude separation is otherwise assured, a right or left turn will be made to clear the approach path. The departing aircraft may take off at more than 45° from the approach course of the arrival until 3 minutes before the arrival is estimated over the airport.

19. Approaches

a. For instrument approaches, the tower will specify the following data:

- (1) Initial approach altitude, outbound heading, the distance (in minutes or miles from the appropriate approach fix) at which procedure turn will be executed, procedure turn altitude, minimum altitude over approach fix inbound, final approach course (if other than reciprocal of outbound heading), minimum altitude over the airfield, and missed approach procedures.
- (2) If the aircraft is cleared for a straight-in approach from holding on or en route to the approach fix, specify—the approach course, altitude over the fix inbound, time and/or distance from beacon to airfield, the minimum altitude over the airfield, and missed approach procedure.

Note. The foregoing need not apply where a standard instrument approach procedure is established and the pilot is known to be familiar with such procedure.

b. If a pilot on IFR establishes visual reference with the ground before completing the approach procedure, he must execute the entire procedure unless he cancels IFR and elects to proceed to the airport under visual conditions. However, IFR traffic may be requested by the airfield tower to make VFR approaches if reports

indicate that aircraft can approach with 1-mile visibility and can remain clear of all clouds.

c. The tower may authorize a *contact (visual) approach* if requested by the pilot. Adequate separation will be maintained between all aircraft so cleared, and between such aircraft and other arriving or departing aircraft.

d. The following terminal traffic control communication contacts should be made by the pilot to terminal control without request:

- (1) The time and altitude upon reaching the holding fix or fix to which cleared.
- (2) When vacating any assigned altitude.
- (3) Time of leaving any assigned holding fix.
- (4) When an approach for a landing has been missed, and request further clearance.

Section VI. TRAFFIC REGULATION PROCEDURES

20. General

Air traffic cannot be regulated effectively under instrument flight conditions unless the FOC knows the location of each aircraft in flight within its area. Therefore, if a flight progress report is not received within a reasonable length of time after the estimated time over a compulsory reporting point, the FOC cannot base subsequent regulation on the assumption that the estimated time was accurate. If the report has direct relationship to the regulation of other aircraft, action must be taken to obtain it not later than 3 minutes after estimated time over fix, either by radio call from FOC or from an airfield near the fix.

a. Pilots may be requested by the controller to forward specific information on flight conditions of use in determining appropriate regulation instructions. Where necessary, a specific flight may be requested to forward a flight condition report with each scheduled position report.

b. Action must be taken by FOC to provide for changes in flight conditions. Thus, when VFR flight appears impractical, FOC must issue alternate instructions to IFR traffic which was to fly VFR for a specified portion of a flight. Alternate instructions should be issued whenever necessary to more efficiently regulate traffic.

c. Efficient service requires FOC's to forward current estimates over the last fix within their regulation area, together with any change of altitude or special regulation instructions issued to aircraft, to the next FOC concerned and to monitoring FOC (if applicable) via direct telephone circuits. The transmission of fix

estimates should be made as soon as possible but not later than 3 minutes prior to the time aircraft are estimated to enter the next FOC regulation area. If no position report is received within the FOC regulation area, the next FOC should be notified of this fact when the current estimated position of the aircraft is given. Whenever the next FOC regulating the aircraft issues instructions requiring a change in the flight of the aircraft within another FOC's regulation area, these instructions should be routed through the FOC concerned.

d. Although flights are normally cleared from point of departure to destination, changes in flight plans may occur. In any event, the following data will be forwarded from FOC to FOC as an IFR flight progresses :

- (1) Flight identification and type aircraft.
- (2) Estimates and altitude over the last fix within the regulation area, and the altitude of entry into the adjacent FOC's area if different from the altitude over the last fix.
- (3) Actual groundspeed, if determined.
- (4) Any changes in flight plan or clearance subsequent to initial clearance.
- (5) The estimated time of arrival as specified in the flight plan (time of departure plus elapsed time).
- (6) Clearance information :
 - (a) Clearance limit, if other than the airport of destination.
 - (b) Special information, if issued.
- (7) Altitude(s) requested by the pilot (as specified in the flight plan or subsequently requested en route).

21. Listening Watch

While en route, the pilot must, unless instructed otherwise, maintain a constant "listening watch" with the FOC of the area in which he is operating for possible information or instructions essential to traffic regulation. Should the presence of another aircraft at the same altitude in the same vicinity be discovered, the pilot is immediately advised and an amended clearance is issued. If traffic congestion occurs at any point on the air route, the aircraft may be required to *hold* (par. 22) at a radio fix en route until the congestion has been eliminated. Efficiency of operation and safety are greatly improved when each aircraft is able to respond immediately to instructions from the FOC; for example, when letdown and low-approach clearance is available before the aircraft actually arrives at the radio facility of the destination.

22. Holding

Holding is maneuvering an aircraft within a predetermined airspace at constant altitude while awaiting further instructions.

Holding instructions may be given to aircraft by airfield control or by the appropriate FOC. An aircraft arriving over the destination LMF beacon prior to receipt of holding instructions should immediately enter into the holding pattern prescribed for that airfield while contacting the appropriate regulating facility. In the absence of a prescribed holding pattern, a standard type en route pattern should be flown until further instructions are received. A specified holding point will normally be the low-frequency homing beacon. Holding instructions will normally specify the holding altitude and the bearing along which the aircraft will hold (fig. 8).

23. Stacking

Stacking is the process of arranging aircraft awaiting landing instructions at various altitudes. This is accomplished by clearing a number of aircraft to hold on a given LMF beacon at intervals of at least 500 feet of altitude. As the aircraft at the bottom of the stack is cleared for an instrument approach, all other holding aircraft are instructed to descend 500 feet as each lower altitude becomes vacant. Instrument low-approach clearances are given to the aircraft at the bottom of the stack only (fig. 9). To facilitate flow of en route traffic over the LMF beacon, FOC can leave 500-foot intervals in the stack unassigned for use of traffic which must clear through FOC before proceeding through the stack.

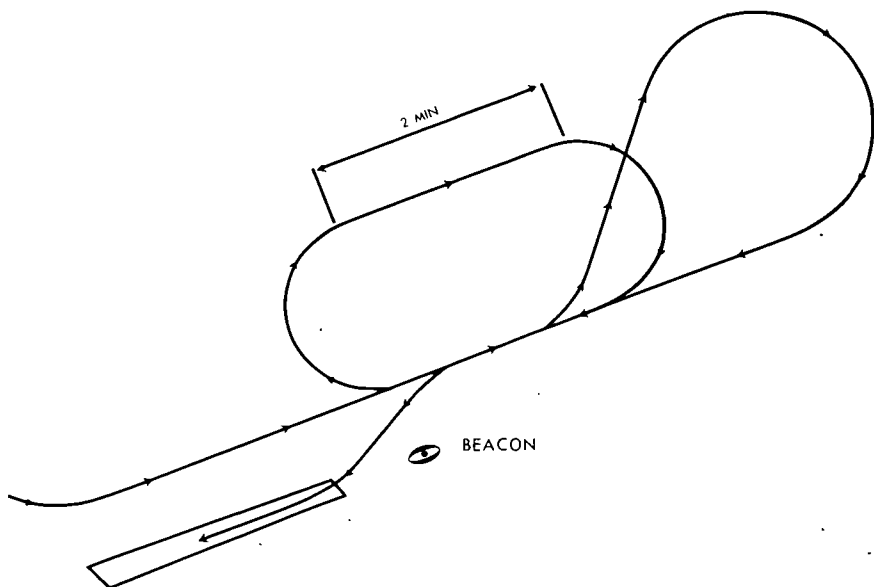


Figure 8. Standard holding pattern.

24. Procedure Turns

A *procedure turn* is a maneuver for reversing the heading of an aircraft on a bearing. Three types of procedure turns (fig. 10) in normal use are the 60-second, the 40-second, and the 90°.

25. Low Visibility Approaches

When a straight-in landing is impossible because of extremely high winds, obstructions on the runway, etc., the pilot may have to make a low-visibility approach (fig. 11) in order to align his flight path with the desired runway. This is accomplished by

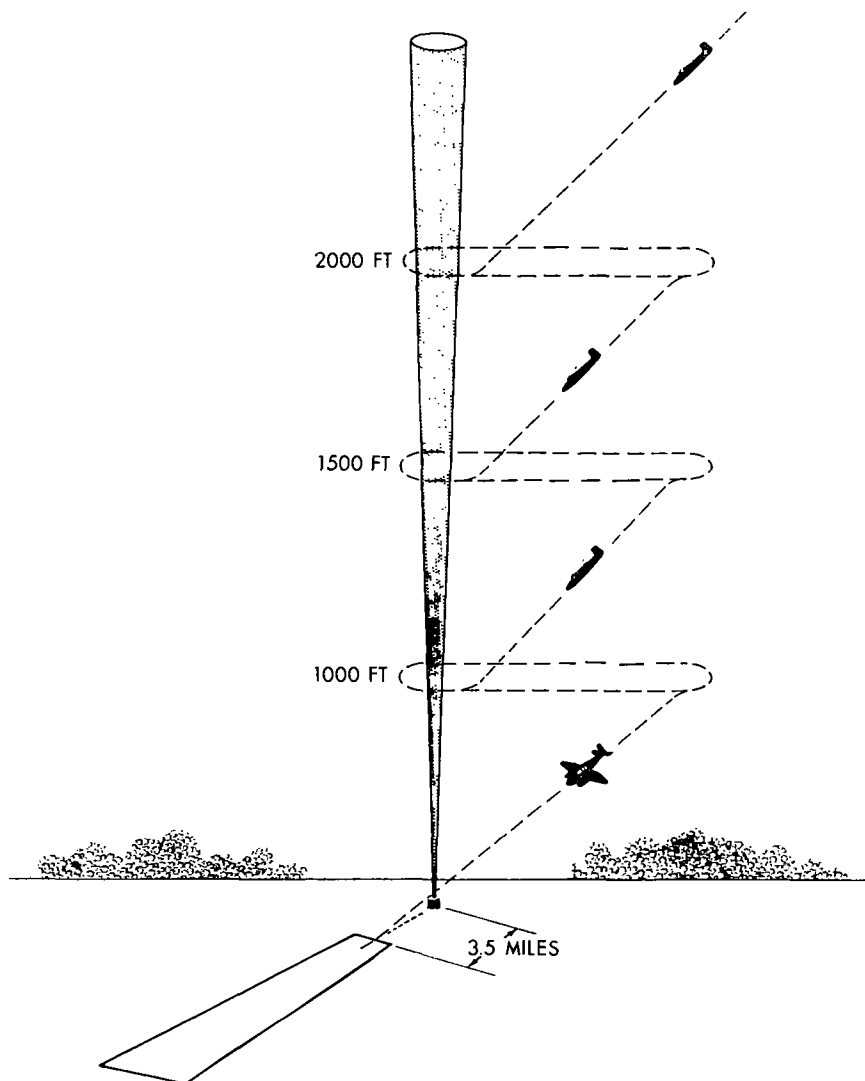
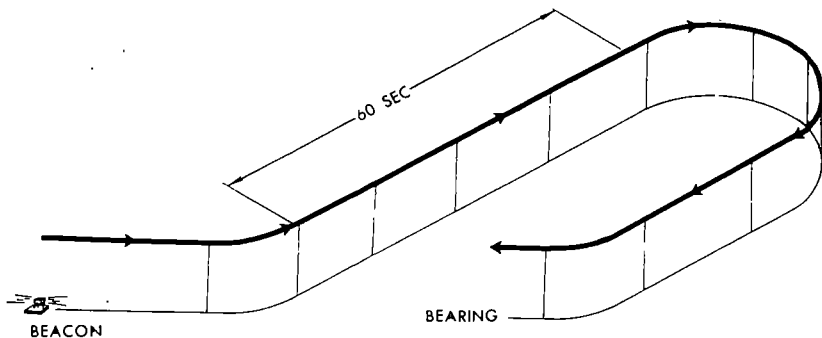
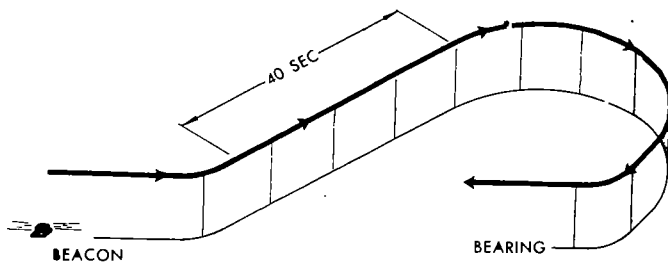


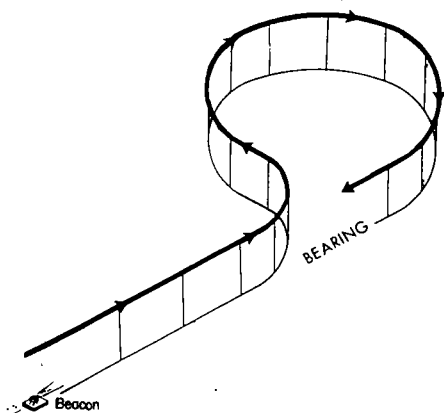
Figure 9. Stacking procedures.



A 60-SECOND TYPE PROCEDURE TURN



B 40-SECOND TYPE PROCEDURE TURN



C 90° TYPE PROCEDURE TURN

Figure 10. Procedure turns.

flying downwind directly over the landing runway and, as the end of the runway is reached, executing either a 40-second or a 90° type procedure turn. This turn can be made in either direction, with preference given the direction affording the greatest clearance of obstacles around the field.

26. Missed Approaches

In the event of a missed approach, a prescribed missed-approach procedure of the airfield must be followed and the airfield control tower notified, unless an alternate missed-approach procedure is specified by the FOC. A new approach clearance will be obtained prior to beginning another approach. Under normal circumstances, when the fuel supply is sufficient, the aircraft is directed to the top of the stack to await another attempt at the low approach. If the pilot elects to proceed to the alternate airport as specified in his flight plan, he must advise the FOC and obtain a new traffic clearance.

27. Emergency Procedures

a. If the pilot is lost and radio failure consists of inoperative transmitter only, he executes an emergency SOP pattern as established by the field army commander. Radar will then be employed to vector and bring the aircraft to VFR altitude and area. If both the transmitter and the receiver are inoperative, the pilot will fly an emergency pattern as previously established by the army commander. When this emergency pattern is observed by a radar controller, an escort aircraft may be dispatched to provide possible assistance to the distressed aircraft.

b. If the pilot proceeds according to the latest traffic clearance *but* has not established communication with the tower, and if other

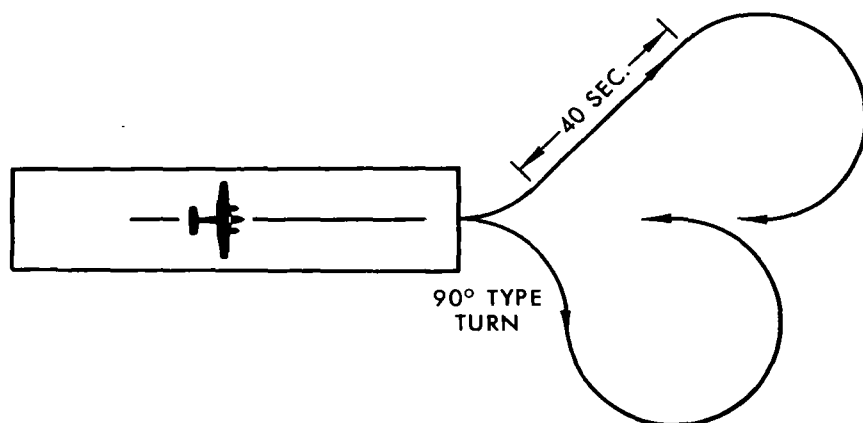


Figure 11. Low visibility approaches.

instructions to the contrary are not received, he may proceed according to the latest traffic clearance; or if he has not established communication with the tower, and if other instructions to the contrary have not been received, he will be expected to observe the following procedures, with regulation effected accordingly:

- (1) If the pilot has received and acknowledged a clearance to the destination airport of LMF beacon serving that point, he shall continue flight at the altitude(s) last assigned by FOC, or the minimum instrument altitude, whichever is higher, to the LMF beacon serving the destination airport.
- (2) If the pilot has received and acknowledged a clearance to a point other than the destination airport or the LMF beacon serving the destination airport, he shall continue flight at the altitude(s) last assigned by FOC or the minimum instrument altitude, whichever is higher, to the LMF beacon serving the destination airport.
- (3) If en route holding instructions have been received, the pilot shall comply with these holding instructions until such time as he continues flight so as to arrive at the LMF beacon serving the destination airport at the expected approach time last received and acknowledged, maintaining the last assigned altitude or the minimum instrument altitude, whichever is higher.
- (4) If en route holding instructions have been received, but no expected approach time has been received, the pilot shall comply with these holding instructions until that time at which FOC specified that further clearance could be expected. He shall then continue, maintaining the last assigned altitude or the minimum instrument altitude, whichever is higher.
- (5) If no expected approach time was received, descent shall be started at the last estimated arrival time specified by the pilot, or as soon as possible thereafter. The altitude at which the aircraft is to arrive over his destination fix, and all altitudes below it, are held open for a period of from 10 minutes prior to his ETA to 30 minutes after, in the event the aircraft has failure of two-way radio communication.
- (6) (a) Since there is always a possibility of collision with unreported aircraft, the FOC or airfield will restrict other IFR traffic for such aircraft. The period of restriction will be 30 minutes after one of the following times, whichever is applied:
 1. Approach time last delivered to the aviator.

2. The current FOC or pilot estimate (whichever is the later) of initial arrival over the beacon.
- (b) If after the expiration of this period, the aircraft is still unreported, normal regulation may be resumed according to the command SOP. The staff aviation officer of the area command will establish regulations to govern these instances.

c. When required by the use of VT fuzed projectiles, friendly or enemy use of nuclear weapons, air defense or drone operations, the Scat Plan (*see* Glossary) for Army aircraft is implemented by broadcast over the air traffic regulation channel. Scat Plans will utilize the UTM Grid System and prearranged codes for uniformity and speed of execution. SOP's must cover the possibility of communication failure between action agencies and the area FOC for air warning on the use of VT fuzes and nuclear weapons. Alternate systems of broadcasting these warnings will be provided in SOP's to allow direct broadcast by agencies having knowledge of impending use of these weapons; i. e., artillery fire direction centers, fire support coordination centers, aviation units, and forward area headquarters.

Section VII. ALLOCATION OF REGULATION RESPONSIBILITY

28. General

Both airfield traffic control and flight operation centers share responsibility in the regulation of traffic. The FOC is responsible for the regulation and identification of all traffic within its area except within airfield control zones. Within airfield control zones, the airfield traffic controllers communicate directly with arriving aircraft and issue instructions in accordance with established local procedures utilizing tower radio facilities.

29. Regulation Responsibility

Division of regulation is as follows:

a. The FOC provides separation between all aircraft operating under IFR within its area except those released to airfield control upon arrival over the holding fix and within the airfield control altitude. In order to insure regulation and separation of holding and through traffic, the FOC will normally maintain control of the airspace over the holding fix from a specified altitude upward. This altitude will be established for each locality by the appropriate area commander. The airfield control provides separation between departing aircraft and aircraft on an approach from the holding fix.

b. Under approach sequence conditions, the FOC clears aircraft to the holding point and states the holding instructions and expected approach time in the clearance. Expected approach time is the time expected for an arrival to be cleared to commence approach for a landing. Approach times must be issued and kept current if any portion of the approach is to be conducted under IFR. When the FOC or airfield control tower exercising approach control determines that delays will occur in landing, aircraft and tower/approach control or FOC's concerned will be notified, and revised approach times will be issued. The holding point is normally the low frequency beacon from which the approach to the airport is to be accomplished. When the aircraft reaches the holding point and has been cleared to airfield control altitude, the airfield tower takes over upon release by FOC. Should the aircraft miss its approach, the tower must notify FOC and return control of the aircraft to FOC if, for any reason, terminal control is unable to maneuver the aircraft within the airspace allotted to airfield control.

c. The FOC issues all IFR clearances for aircraft departing from an airfield. The most important clearance data are altitude(s) at which reporting points are to be crossed, the cruising altitude, and the time of takeoff. Depending on other traffic, the FOC may or may not specify the takeoff time in the clearance it approves. If the FOC does not specify takeoff time, airfield control will determine the time and coordinate the flight with other flights as necessary. The FOC occasionally includes a *void* time on the clearance: the time of cancellation of the clearance. If the aircraft has not taken off by void time, or has failed to comply with certain other instructions, a new clearance must be issued. Airfield control also issues a clearance void time, but such time is never later than that established by the FOC.

d. Safe and expeditious movement of aircraft requires close, joint cooperation between each airfield control zone and its FOC in exchanging data.

- (1) Airfield controllers advise FOC's of pertinent data on IFR traffic, such as—
 - (a) Lowest vacant altitude at the holding point.
 - (b) Average time interval between successive approaches as determined by airfield control.
 - (c) Any change in the expected approach time issued by the FOC when the airfield control calculation indicates a variation of 10 minutes or more.
 - (d) Arrival times (if necessary) over holding points.
 - (e) Departure time of departing aircraft.
 - (f) Available information relative to overdue or unreported aircraft.

- (2) FOC's advise airfield control of pertinent data on IFR traffic, such as—
 - (a) Identification, type, and point of departure of arriving aircraft.
 - (b) Estimated time and proposed altitude of arrivals over holding point, or actual time if aircraft is to be released to airfield control after arrival over the holding point.
 - (c) Expected approach time issued.
 - (d) Statement that the aircraft has been cleared to airfield control, or that the airfield tower should assume control.
 - (e) Anticipated delay to departing IFR traffic due to airway congestion.

Section VIII. IDENTIFICATION AND AIR DEFENSE OPERATIONS

30. Identification

a. General. Measures utilized for the identification of Army aircraft in the combat zone are prescribed by the theater commander. These identification measures are based on published allied and joint communication procedures (ACP's and JANAP's), current identification procedures and criteria pertinent to Army aircraft as may be published, and the requirements of the air defense situation within the theater. These measures are implemented by integration into the established Army air traffic regulation system in the combat zone.

- (1) Such operations include the following:
 - (a) The FOC informs the AADCP of any flight outside air corridors (routes) at the time the flight is to begin.
 - (b) The AADCP monitors the air defense intelligence service plots until the flight in question is positively identified. Thereafter, it continuously monitors the flight until it lands or reenters an air corridor, making available to the FOC continuous track position data so that the FOC may exercise traffic regulation.
 - (c) Should the identity of any flight appear in doubt, the FOC assists the AADCP in attempting to establish identity. In doing so it may recheck flight plans, communicate with other FOC's, establish radio communication with the flight in question, and order flight maneuvers as necessary to effect positive identification.
- (2) The density of aircraft operating outside air corridors (routes) normally will not be as great as those operating

in the corridors. Therefore, the air defense information service concentrates its attention on these flights, insuring continuous, positive identification. Both visual and radar tracking will be used for flights over friendly areas. For flights returning from hostile areas, the time, altitude, direction of flight, and place of reentry must be closely coordinated to insure safety for the returning aircraft from friendly fire.

b. *Identification Measures.* Means of recognition and identification of Army aircraft in the combat zone are as follows:

(1) *Daylight visual conditions.* During daylight visual conditions, appearance, visual signals, and general behavior will be the primary means of identification and recognition of Army aircraft by forward area air defense weapons employing visual means for aircraft detection and fire control. Aircraft will utilize flight plan correlation and IFF as the primary means of identification and recognition by air defense weapons systems employing radar means for aircraft detection and fire control. Air routes will normally be utilized in friendly rear areas to canalize friendly air traffic and facilitate recognition. Flight plans for Army aircraft under VFR conditions will be utilized primarily for identification purposes.

(2) *Instrument flight conditions.* Flight plans as required of all Army aircraft flying during IFR conditions will also be used as a means of identification. Air routes will be habitually used in friendly rear areas during such conditions, as a traffic regulation measure to prevent mutual interference of friendly aircraft and to canalize friendly air traffic for air defense purposes.

c. *FOC-AADCP Procedures.*

(1) *Flight plan procedures.* On receipt of a flight plan at FOC, the flight plan is recorded and pertinent information passed to the AADCP. AADCP's, in turn, communicate this flight information to all subordinate elements and fire units affected by the flight. For detailed procedures, see paragraph 82.

(2) *Radio identification procedures.* The FOC will accomplish recognition of Army aircraft by radio—when prescribed as a corollary to flight plans for initial recognition, when challenging an otherwise unknown aircraft, or as part of emergency procedures. Such recognition and identification require proper use of authentication procedures and known aircraft position. When identification is initiated, communication is conducted on the air traffic regulation channel.

- (3) *Emergency radio identification.* Emergency radio identification is accomplished by transmission of proper recognition signals from the aircraft as prescribed. When such transmission is received by the flight operations center, the AADCP is advised and transmits an identification of the aircraft over the AADCP communication system.

31. Traffic Regulation Measures

Regulation measures in the air traffic regulation system are (1) those primarily for the purpose of facilitating traffic flow and (2) those primarily for the purpose of facilitating air defense functions of the command. The traffic flow measures are standing measures, and in practice, are subject to little variance, while the air defense measures are subject to change or modification with relative frequency, dependent on the current requirements of the air defense situation within a theater of operations. Many regulation measures for facilitating traffic flow also facilitate air defense operations. Regulation policy is established by appropriate commanders so as to place minimum restrictions on utilization of Army aviation by subordinate commanders. Implementation of regulation is accomplished by designated commanders and is coordinated with other services by aviation staff officers and air defense commanders.

32. Air Defense Procedures

The establishment of positive definitive procedures for air traffic regulation and identification is necessary to insure maximum effectiveness of active air defense means and to provide protection of friendly aircraft from friendly air defense fires. The objective of Army air defense is denial of penetration of the airspace above the defended area. To achieve this objective and yet provide for the safe and orderly flight of friendly aircraft, procedures are established for—

- a. Dissemination of friendly aircraft identification information.
- b. Attack of hostile aircraft.
- c. Employment of air defense nuclear warheads.

CHAPTER 3

NAVIGATION METHODS

Section I. AIR NAVIGATION PRINCIPLES

33. General

The field army aviation officer is responsible for the establishment and operation of the Army aviation navigational system within the field army area. The navigation system and the Army air traffic regulation system must be closely integrated for efficient regulation of Army air traffic. Establishment of navigation facilities will therefore be closely coordinated internally and with other Services to achieve complete integration and maximum utilization. Figure 12 shows the primary Army aviation navigation system in the combat zone.

34. LMF Radio Beacons

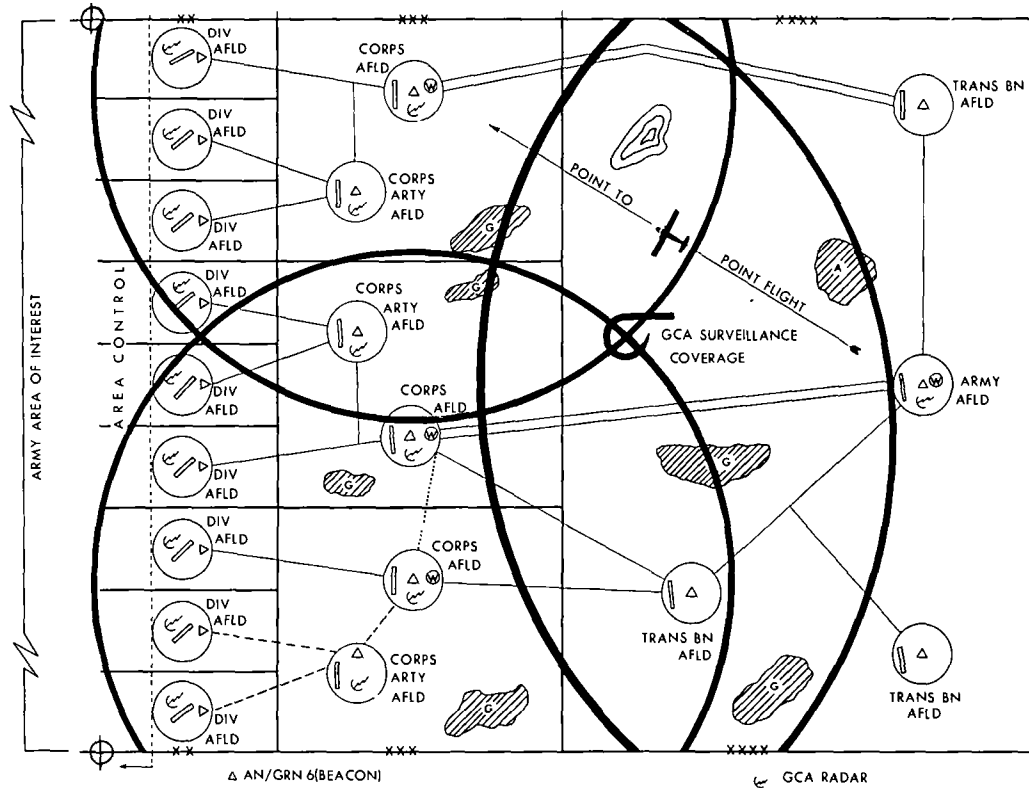
LMF beacons (AN/GRN-6) (app. IV) provide the primary navigation facilities that define the air routes and are normally located at major airfields of the field army so that they may also serve as terminal approach facilities for these airfields. Beacons are placed 3 to 5 miles from the airfield in line with the runway to facilitate the approach (fig. 13).

35. Radar

Ground Control Approach (GCA) radars, AN/FPN-33 (app. IV) are located at division, corps, and army base airfields and at other major airfields in the field army to provide primary terminal approach facilities. They offer a means of more precise approaches to the runway than that afforded by use of LMF beacons and, when operated in a surveillance mode, provide a means of affecting traffic regulation and control for the air traffic within the range limits of the radar.

36. FM Homing

a. The FM radio in the aircraft with FM homing adaptor, AN/ARA-31 (app. IV) provides a means of navigation to destinations other than established airfields. It can be utilized for navigation to tactical unit locations or small airfields, particularly in forward areas, and requires only a keyed tactical FM radio at destinations on which to home. It can also be used as an alternate means of navigation for major airfields and as a means of effecting a rendezvous with other aircraft.



GCA SURVEILLANCE (ILLUSTRATING COVERAGE OF CORPS AND ARMY INSTALLATIONS ONLY)

NOTE REFER TO FIG 1-1 FOR EXPLANATION OF SYMBOLS.

Figure 12. Army aviation navigation system in the combat zone.

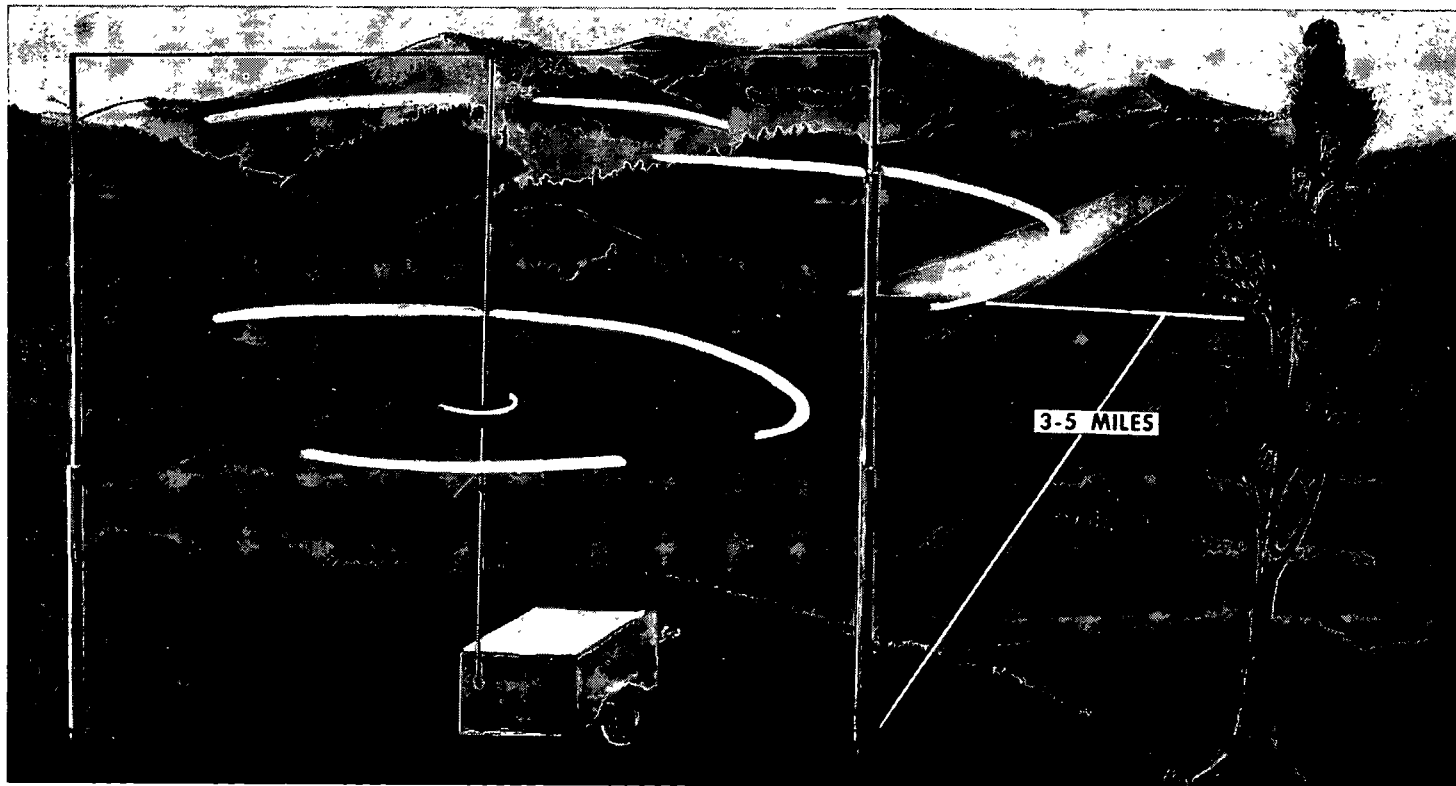


Figure 13. AN/GRN-6 radio beacon operations.

b. This system does not permit determination of relative bearings or selection of a particular inbound radial, and is more subject to wind drift error and line-of-sight operation than is the LMF beacon system.

Section II. SUPPLEMENTARY NAVIGATION FACILITIES

37. General

a. Supplementary navigation facilities are used in the event of inflight emergency, equipment failure, or other reason which precludes use of primary navigation facilities. Air defense, Air Force, and artillery surveillance radar agencies can furnish positions, inflight emergency navigational aid such as headings to destination airfields, etc. In some cases, these agencies may require an identifying pattern to positively identify the lost aircraft.

b. The FOC provides inflight assistance to Army aircraft within its area by—

- (1) Advising the pilot of available alternate airfields and prevailing weather conditions.
- (2) Providing emergency navigational information received from other agencies.
- (3) Alerting various airfields, letdown, and navigational facilities.
- (4) Plotting vectoring time and distance data by reference to the AADCP operations board.
- (5) Special emergency use of individual air defense surveillance radar, or radar assistance from Air Force CRC (control reporting center) or CRP (control reporting point).

38. Air Defense Radar

Radar plot data at the AADCP is used by the flight operations officer to vector Army aircraft. Use of AADCP facilities in connection with Army aviation is possible through proximity of the FOC and AADCP. Radars commonly available for use in this capacity are the AN/TPS-1D surveillance radar, the NIKE AJAX and NIKE HERCULES acquisition and tracking radars, and the HAWK acquisition radar. AADCP upon request furnishes information regarding Army aircraft by plotting the aircraft track on the operations board. This plot is then visually transplanted to the aircraft plotting board in the FOC, enabling the FOC commander to direct Army aircraft to safety if lost, or to identify the aircraft if it is in an area protected by air defense weapons. For detailed description of procedures, see paragraph 92.

39. Other Service Radar

Other Service surveillance radar, located within the field army area, may be used by Army aircraft for emergency navigational assistance. Procedures used are similar to those employed with air defense radar. Detailed procedures are contained in paragraph 92.

CHAPTER 4

COMMUNICATIONS

Section I. GENERAL

40. Communications

Army aviation support in combat is dependent on effective, adequate, reliable, and flexible communications between aviation elements and supported elements of the command. Responsible ground and aviation personnel must be thoroughly trained in the various means of communication.

41. Means of Communication

To increase reliability, communication methods must be employed to supplement each other. The means employed in a given situation are generally those that provide maximum reliability, flexibility, secrecy, and speed with a minimum of effort and material. The following methods of communication are available to Army aviation combat operations.

a. Ground-to-Ground Communications.

- (1) *Radio.* Voice and telegraph (Morse and teletypewriter).
- (2) *Wire.* Telephone, and teletypewriter.
- (3) *Visual.* Pyrotechnics, arm signals, panels and lights.
- (4) *Messenger.* Air, ground vehicle, and foot.
- (5) *Sound.* Whistles, horns, gongs, gunfire.

b. Air-Ground Communications.

- (1) *Radio.* AM and FM voice.
- (2) *Visual.* Pyrotechnics, smoke, lights, panels, arm signals, and aircraft maneuvers.
- (3) *Message drop and pickup.*

c. Air-to-Air Communications.

- (1) *Radio.* AM and FM voice.
- (2) *Visual.* Pyrotechnics and aircraft maneuvers.

42. Orders and Instructions Affecting Communication

a. Standing operating procedure (SOP) pertaining to communication is prepared by aviation units based on higher echelon SOP. Standing operating procedure is particularly applicable to communication procedures since many of these procedures are similar in most tactical operations.

b. Standing signal instructions and signal operation instructions, referred to as the SSI and SOI respectively, are signal orders issued for technical control and coordination of the signal com-

munication activities of a command. The SSI contain instructions for the operation of communication equipment, agencies and means, as well as instructions for the use of operational data found in the SOI. Examples of the information found in the SOI/SSI are radio call signs and frequencies, codes and ciphers, visual signal (to include air-ground recognition), and telephone/teletype instructions.

c. In addition to the above signal orders, the commander disseminates further signal instructions for a particular operation in paragraph 5 of an operation order.

d. A detailed explanation of signal orders can be found in FM 11-16.

Section II. ARMY AIR TRAFFIC TACTICAL COMMUNICATIONS

43. General

Army air traffic tactical operations are dependent upon adequate communications. Without adequate communications, the entire traffic regulation system would be inoperative. Telephone circuits are the primary means of ground communication and are used for the transmission of flight plans, flight clearances, reports, emergency data, and traffic regulation information. Voice-frequency teletypewriter circuits are used for the transmission of routine weather and NOTAM information and as a backup to the telephone circuits. Radio is used for air-ground-air communication between airborne aircraft and the FOC, airfield control tower, elements of the supported units, and other ground facilities as required.

44. Radio Communication

a. General. Flexible and mobile radio communication is an essential means of communication in fast moving situations and to highly mobile elements. However, radio communication is subject to deliberate jamming or other forms of interference, lacks security and involves regular maintenance of equipment by specially trained technicians. Also, the range and quality of radio communication are affected to a varying degree by the frequency used, the weather, the nature of intervening terrain and obstacles, the time of day, the season of the year, and electrical disturbances.

b. Message Relay. Relay of messages through an intermediate station can be employed to provide communication between aircraft and ground stations or between two ground stations when direct radio contact cannot be maintained. Methods of relaying transmissions between an aircraft and FOC are as follows:

- (1) Aircraft contacts the nearest tower (airfield) facility by radio. The tower then relays information to FOC by

direct telephone. Advantages of this method are that trained personnel may act as relay agents, distances to tower facilities are ordinarily well within radio range, direct communications exist between towers and FOC, alternate means of communication exist if direct lines are inoperative, and tower can take action to direct aircraft if required. Disadvantages include an inevitable time lag in forwarding FOC instructions, the possibility of error in retransmission, and the cluttering of local air traffic regulation channels.

- (2) The FOC requests a nearby unit to fly an aircraft to a selected area to act as a relay station. Advantages of this method are that a wide coverage is provided since the antennas are effectively elevated, direct communications between relay aircraft and FOC are assured, and several channels of communication are available. Disadvantages are outlined in (1) above, with the additional disadvantage that reliance must be placed on another agency to provide the required pilots and aircraft.
- (3) An aircraft with FM retransmission equipment is placed in support of the FOC as required. Advantages of this method are stated in (2) above, plus the added advantage of having transmissions automatically relayed without the intervention of the pilot or the relay aircraft. This affords, in effect, a direct communication channel between aircraft and FOC. Disadvantages include the requirement for dual installation of FM radios and antennas in the relay aircraft and for two separate FM channels, and limited availability of relay aircraft for other missions.
- (4) The preferred method is (1) above since it may be immediately effective, requires minimum support from other agencies, and will usually be effective over distances required for most operations.

45. Types of Radio Communication

Types of radio communication normally employed in the regulation and control of tactical air traffic operations and the specific uses of each type are described as follows (fig. 7 and par. 12) :

a. HF Radio. Numerous amplitude modulation (AM) radio equipments operating in the high frequency (HF) band provide a capability for long range voice or telegraphic communication. The relatively low frequency band of this type of equipment which makes it capable of non line-of-sight operations over extended distances also makes it more susceptible to atmospheric interference than the FM or AM radios operating in the higher VHF and

UHF bands. It is used by army aviation elements in the air traffic tactical operation system for the following purposes:

- (1) The AN/GRR-5 receiver is used to monitor the army air defense information service (AADIS) intelligence net and/or the division warning net for reception of hostile air warning at airfields and at FOC's.
- (2) The Radio Set AN/GRC-46 operates in the FOC net and constitutes a backup voice and teletypewriter communication facility between the FOCs in the theater and between the airfields and their respective area FOC's.

b. *FM Radio.* Frequency modulated (FM) radio is the primary type of radio used by army aviation for tactical communication with supported ground elements but is regarded as a secondary means of communication for regulation and control of tactical air traffic operations. The VHF FM band involved is shared by all tactical elements of the field army thereby imposing certain limitations on the number of channels obtainable for army aviation use. It permits reliable voice communication at medium ranges and is relatively interference free, however, some line-of-sight range limitations exist, particularly in the upper portion of the frequency band. This type radio is used by army aviation elements for ground-to-ground, air-ground-air, and air-to-air communications employing the AN/ARC-44 radio sets and Monitor Receiver AN/ARR-46 in aircraft and the AN/VRQ-2 or similar FM radio sets on the ground. Their use in the air traffic tactical operation system is as follows:

- (1) Secondary air-ground-air communications on the air traffic regulations, airfield control, and radar approach control channels.
- (2) Ground to air warning.
- (3) Radio relay.

c. *VHF and UHF AM Radio.* Amplitude modulated (AM) radio operating in either the Very High Frequency (VHF) or the Ultra High Frequency (UHF) bands (depending on theater requirements) constitutes the primary means of air-ground-air communications for use in the regulation and control of air traffic. Since the ground elements in the field army are not normally equipped with this type of radio, its use is limited essentially to military aviation and it can also be utilized for communications with aviation facilities of the other services. It permits medium range voice communication that is relatively interference free but is generally limited in range to line-of-sight distances. This means of communications is used by army aviation elements in the air traffic tactical operation system for primary air-ground-air communications on the air traffic regulation, airfield control, and radar ap-

proach channels. Aircraft radios of this type are the ARC type 12 and AN/ARC-73 VHF equipment and AN/ARC-60 and AN/ARC-55 UHF equipment. Ground installations are equipped with such items as the VHF AN/TRC-42 and the UHF AN/VRC-24, AN/TRC-68 and AN/ARC-27.

Section III. COMMUNICATION SECURITY

46. General

Communication security is the security resulting from the observance and practice of security regulations and methods designed to prevent or delay unauthorized persons for gaining information of military value from communication sources.

47. Elements of Communication Security

Three elements of communication security are physical, crypto, and transmission. The maintenance of communication security is a command function. All personnel must be cognizant of this security, particularly those who personally transmit radio messages. The commander establishes communication security measures by stating general principles in the unit SOP, by announcing before an operation the extent to which security is to be practiced in that operation, and by making security decisions during an operation. Messages that might compromise the plans, operations, or crypto systems of other units are never transmitted in the clear.

a. Army aircraft must employ an authorized authentication system for use in radio communications concerned with the operation of the air traffic regulation and identification system.

b. Common code names and words, for brevity and security, should be included in air traffic regulation radio transmission.

CHAPTER 5

WEATHER SERVICE SUPPORT

Section I. GENERAL

48. Weather Facilities

Four principal types of technical facilities are provided by the United States Air Force Air Weather Service to meet the weather requirements of army theater forces. These are—

a. Theater Weather Central. The theater weather central is a diversified facility capable of preparing weather analyses and forecasts covering an entire hemisphere. This facility is assigned to the headquarters of the Air Force weather wing which services theater army forces. It serves as a source of weather information for use in theater planning and provides technical meteorological support to forecast centers and weather stations in the theater. This support includes the following:

- (1) Preparing and disseminating facsimile weather charts of the theater and other areas of operational interest.
- (2) Providing climatological and other special meteorological studies.
- (3) Providing forecast guidance.
- (4) Providing operational and planning forecasts for periods which exceed the capability of weather centers and stations (usually for periods over 48 hours).
- (5) Disseminating basic weather data by means of the theater weather data broadcast.

b. Tactical Forecast Centers.

- (1) A tactical forecast center is a mobile facility which provides weather service for major air and ground components in a theater of operations, and technical support to tactical weather stations. Tactical forecast centers are located at army group and field army level.
- (2) The field army tactical forecast center of a tactical weather squadron is located with the headquarters of the field army. It is the central agency for the collection, evaluation, and further dissemination of weather reports generated within the tactical air force-field army area of responsibility. This center prepares current weather reports, weather summaries, and forecasts for periods up to 48 hours. It provides aviation weather observing and forecasting service for the field army base airfield and other aviation elements of the field army as required. It

has characteristics of mobility comparable with those of the field army headquarters.

c. Tactical Weather Stations. These stations provide around-the-clock weather forecasting and observing service. They operate as detachments of the tactical weather squadron and are located at field army headquarters, corps headquarters, and tactical air bases.

- (1) *Field army tactical weather station (augmented).* The field army tactical weather station of a tactical weather squadron is located with the headquarters of the field army. It is augmented to provide forecasting, climatological, and staff briefing service in addition to that furnished by the field army tactical forecast center. Its functions are similar to those performed by the tactical forecast center.
- (2) *Corps tactical weather stations.* The corps tactical weather station serves corps headquarters and operational agencies such as the FSCC (fire support coordination center), FOC, and AADCP, providing weather service for division and other subordinate elements of the corps. To accomplish this, it—
 - (a) Maintains continuous surveillance over weather conditions in the corps area and adjacent areas of interest and advises the corps commander and his staff on changes and developments in weather.
 - (b) Disseminates pertinent weather forecasts, advisories, and other information through appropriate Army communication channels to the divisions and other subordinate elements of the corps.
 - (c) Furnishes experienced weather personnel for divisions and other subordinate elements of the corps to provide advisory weather assistance.
 - (d) Provides weather observing and forecasting service for Army aviation elements at the corps airfield, and other weather information required for use by corps aviation elements.
 - (e) Collects, evaluates, and further disseminates weather data generated within the corps area.

d. Tactical Weather Observing Facilities. In addition to weather stations at army, corps, and tactical air bases, three additional types of tactical weather observing facilities supplement other sources of weather data in a theater of operations.

- (1) *Tactical observing station.* This station is a mobile facility which provides surface observing service and visual winds aloft observations.
- (2) *Tactical observing team.* This team consists of two or

more weather observers equipped to furnish a portable observing service. It provides limited surface weather observation from the forward combat area.

- (3) *Tactical rawinsonde station*. This station is a mobile facility equipped to provide air sounding data, wind, temperature, and moisture distribution aloft.

49. Weather Service in the Combat Area

Weather service in the combat zone is provided Army aviation by weather teams at field army and corps base airfields. These teams are normally attached to the headquarters and headquarters company of either field army or corps for administrative and logistical support. Signal elements of field army and corps provide communication facilities to accomplish the following:

- a. Transmission of weather data, coded analyses, weather forecasts, weather maps, and charts from the weather central.
- b. Collection of weather data originating with elements of the field army and the dissemination of weather information to field army units and agencies.
- c. Coordination of forecasts by telephone between the weather teams and field army or corps weather stations.

50. Weather Teams at Army Airfields

Weather teams at Army airfields are normally located immediately adjacent to or included as a part of airfield operations. This close association is necessary to facilitate—

- a. Briefing and debriefing of aviators.
- b. Ready access to communication facilities or dissemination of weather information to —
 - (1) The airfield traffic control team (tower).
 - (2) The approach control team (GCA).
 - (3) Other Army aviation installations within the field army.

Section II. WEATHER INFORMATION

51. Dissemination of Weather Information

Dissemination of weather information is accomplished as follows:

- a. The frequency of weather broadcasts to Army airfields and FOC's will depend on local meteorological conditions. Broadcast schedules will be arranged through coordination between the field army aviation officer and staff weather officer. These broadcasts will be transmitted over the field army and army airfield teletype-writer net as appropriate.

b. Dissemination of weather to inflight aircraft is accomplished—

- (1) To aircraft in contact with airfield facilities. The tower or radar approach team will rebroadcast requested weather information over the appropriate channel. Local security regulations will govern the application of this service.
- (2) To aircraft in contact with the FOC.
 - (a) Routine weather may be broadcast over the air traffic regulation channel on a time schedule laid down by the field army aviation officer. Normally scheduled radio broadcast of weather sequences will not be necessary because of the reduced distances and time involved for most flights within the field army area.
 - (b) The latest weather information will be transmitted over the air traffic regulation channel upon request by an aircraft. Local security regulations will govern the application of this service.
 - (c) Severe storm warnings and other emergency weather information will be broadcast over all available facilities.

52. Additional Army Sources of Weather Information

In addition to data provided from sources within the Air Weather Service organization (both in the theater and on a global scale) and by the tactical air force, several Army agencies contribute weather data to the weather service.

a. The division aviation company weather observer provides surface observing service, ceiling, and winds aloft observations. He has the following limited weather observing equipment:

- (1) Ceiling light projector.
- (2) Clinometer.
- (3) Ballons with hydrogen generator equipment.
- (4) Wet and dry bulb thermometer.
- (5) Anemometer (wind gauge).

b. Artillery meteorological sections contribute weather data, within the limitations of their primary mission, to the Air Weather Service upon request. These sections provide rawinsonde and surface observations of pressure, temperature, humidity, and wind. They may be found with—

- (1) Field Artillery Observation Battalion.
- (2) Division Artillery.

c. The headquarters battery of the field artillery heavy mortar battalion (TOE 6-625C) is equipped with instruments for measuring surface pressure, temperature, humidity, and wind.

d. The headquarters detachment and each of the four companies of the smoke generator battalion include one enlisted weather observer. These units are equipped with instruments for measuring surface pressure, temperature, humidity, and wind.

e. Army aviators report weather conditions within the field army area.

f. Combat units provide weather data obtained by visual observation, and if required for special purposes, may be equipped with instruments to obtain additional weather data.

CHAPTER 6

THE AIR TRAFFIC REGULATION AND IDENTIFICATION SYSTEM (ARMY)

Section I. MISSION AND CAPABILITIES

53. Mission and Capabilities

The mission of the air traffic regulation and identification system is to provide assistance to aviation elements operating in the combat and communication zones to include operation of principal airfields, en route traffic regulation, and identification of friendly aircraft for air defense purposes. These functions are essential for aviation operations during all conditions of weather and visibility. To accomplish this mission, the system provides—

- a. Flight information and planning data.
- b. Navigational facilities at major Army airfields.
- c. Airfield lighting and instrument approach facilities at major airfields.
- d. Air traffic coordination and regulation under all flight conditions.
- e. A means of integrating Army flight operations with existing air defense systems.
- f. Weather service by means of attached weather team.
- g. Warning and inflight assistance to Army aircraft.
- h. Communications incident to the above functions.

54. Air Traffic Control Team (Tower)

The air traffic control team controls traffic within the local air traffic control zone. It coordinates with the approach control team under instrument weather conditions and at other times as necessary. It provides radio communications for traffic control at the base airfield.

55. Approach Control Team (GCA)

The approach control team provides ground control approach (radar) equipment for control of air traffic in the airfield control zone, as well as a means of letdown and approach for aircraft operating under marginal or instrument weather conditions. Equipment is maintained on a standby basis at all times. It is maintained on an operational basis for training, and during marginal or actual weather conditions.

56. Flight Operations Center

The flight operations center performs the functions of air traffic regulation, identification-warning, and inflight assistance for the assigned area of responsibility. Personnel include the flight operations center commander, his assistants and additional personnel required to perform the air traffic regulating functions of the command to which assigned. For detailed description of the FOC, see paragraphs 70 through 79.

Section II. RECONNAISSANCE, SELECTION, AND OCCUPATION OF POSITION (RSOP)

57. General

The basic principles of conducting any reconnaissance, selection, and occupation of position (RSOP) apply to the AATR&I. A well-trained unit operating under a proven SOP will be capable of moving the base airfield in a minimum of inoperative time. The aviation unit commander should be familiar with the communications systems and the tactical plan of the headquarters to which his unit is assigned. With this knowledge, the commander can select possible airfield locations, conduct preliminary reconnaissance on a continuing basis, and be prepared to move when required. When the new area for the airfield has been designated, detailed reconnaissance can be accomplished and the unit alerted to move.

58. Composition of Reconnaissance Party

Composition of the reconnaissance party depends upon whether the occupation is to be deliberate or rapid. For a deliberate and well-coordinated move, the commander may take a large party, including section chiefs and assistants, to prepare in advance certain portions of the area to be occupied. The composition of this type reconnaissance party will be dictated by time available and amount of work required. Optimum accomplishment would be to preinstall the local wire lines and radar reflectors, and mark the locations for each tent and vehicle. Deliberate planning and preparation should be accomplished for night occupations.

59. General Priority of Emplacement

To insure the establishment of an operational airfield in minimum time, the following general priority of emplacement is recommended:

a. Airfield operations and air traffic control team (tower) installed.

b. Homing beacon and GCA installed and checked out, and airfield lighting installed.

c. Local wire communications and teletypewriter circuits installed as soon as communications personnel are available.

60. General Priority of Communications

In support of the priority of emplacement described above, typical priority of communications will follow the guidelines given below.

a. Initial Phase.

- (1) Establish tower and GCA radios (UHF, VHF, and FM) and local telephone from tower to airfield operations.
- (2) Install telephone circuits to flight operations center.
- (3) Install teletypewriter circuit to flight operations center.
- (4) Install trunk telephone circuits to the appropriate command switchboard.
- (5) Install minimum airfield local telephone circuits.

b. *Expansion and Improvement Phase.* This phase will include additional airfield local telephone circuits and other communications circuits.

Section III. ORGANIZATION OF THE AIRFIELD

61. Location of Elements

a. The airfield operations section will use the general purpose (GP) tent located close to the air traffic control installation (tower). This location should provide easy access from both the runway and local road network since this section will be the hub for vehicular traffic in and out of the airfield.

b. Switchboard operators of the airfield operations section will establish and operate the communications center housed in the CP tent adjacent to the air traffic operations (tower) and the approach control team (GCA) installations.

c. Location of the approach control and traffic control teams is dictated by available radar sites. The length of the remote control cable will determine the maximum distance in locating the approach control team in relation to the actual radar antenna site.

d. Since the teletype set at airfield operations is equipped with a weather keyboard, location of the Air Force weather team at airfield operations is best so that weather information can be received and disseminated whenever the weather team's set cannot be utilized.

62. Navigation Facilities

a. LMF Beacon. This beacon is located 3 to 5 miles off the end of the airfield runway under normal conditions and requires neither onlocation maintenance nor operating personnel. The air controller supervisor will formulate a maintenance and inspection schedule designating one of the organic radio repairmen to conduct periodic inspections of the equipment. LMF beacon remote monitoring equipment may be installed in the tower. Field wire may be used as a connecting link between beacon site and tower. An LMF receiver (R-511) is located in the airfield traffic control tower for monitoring the beacon if wire installation should be impractical.

b. Ground Control Approach Installation (GCA). The location of the GCA Radar is governed by fixed distances in the placement of the reflectors and the necessary angles of site. The transmitter-receiver antenna group must always be placed in the clear, within fixed distance of the runway. Although the indicator group is normally located at or adjacent to the tower installation, it may be deployed any distance from the antenna group depending upon the cable available.

63. Air Traffic Operations

The air traffic control team is provided communications equipment necessary to establish and operate airfield traffic control. The tower installation is located adjacent to the approach control team (GCA) shelter. The transportable airfield tower (AN/TSW-1 or equivalent) can be mounted in a 2½-ton truck or on the ground as necessary. The CP tent of the air traffic control team should be erected adjacent to the tower (fig. 14).

a. The airfield switchboard will be installed in the communications center CP tent. The flight operations officer supervises and is responsible for the installation of the airfield switchboard. He also supervises the installation of the homing beacon, GCA radar, and the airfield control tower.

b. All communication links (i.e., radio remotes, telephone, GCA) are routed into the appropriate sections of this CP tent.

64. Airfield Communication Installations

A typical airfield wire diagram is shown in figure 15. Consistent with communication procedures, this network of local lines will be constantly improved and refined as long as the airfield remains in position. The radios employed by the approach control team will be operated from the GCA console position.

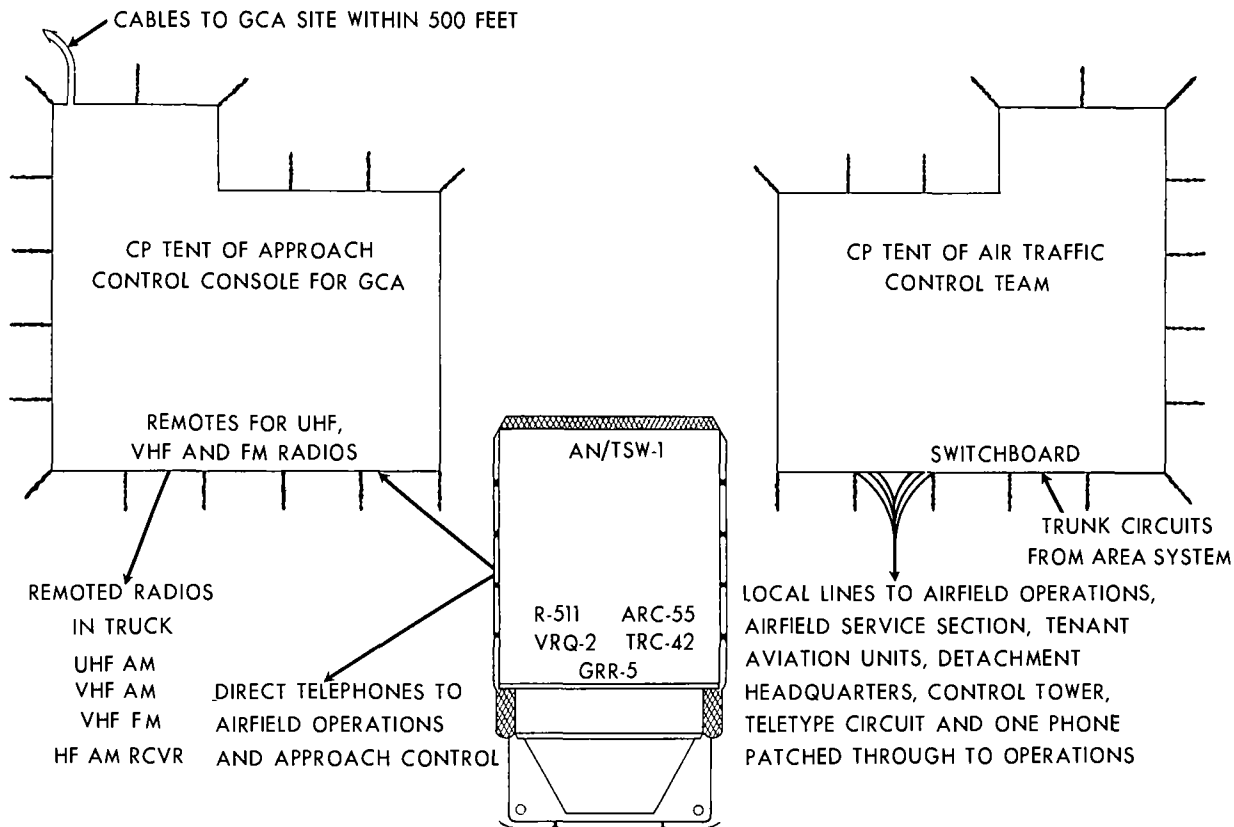


Figure 14. Type tower and radar approach installation.

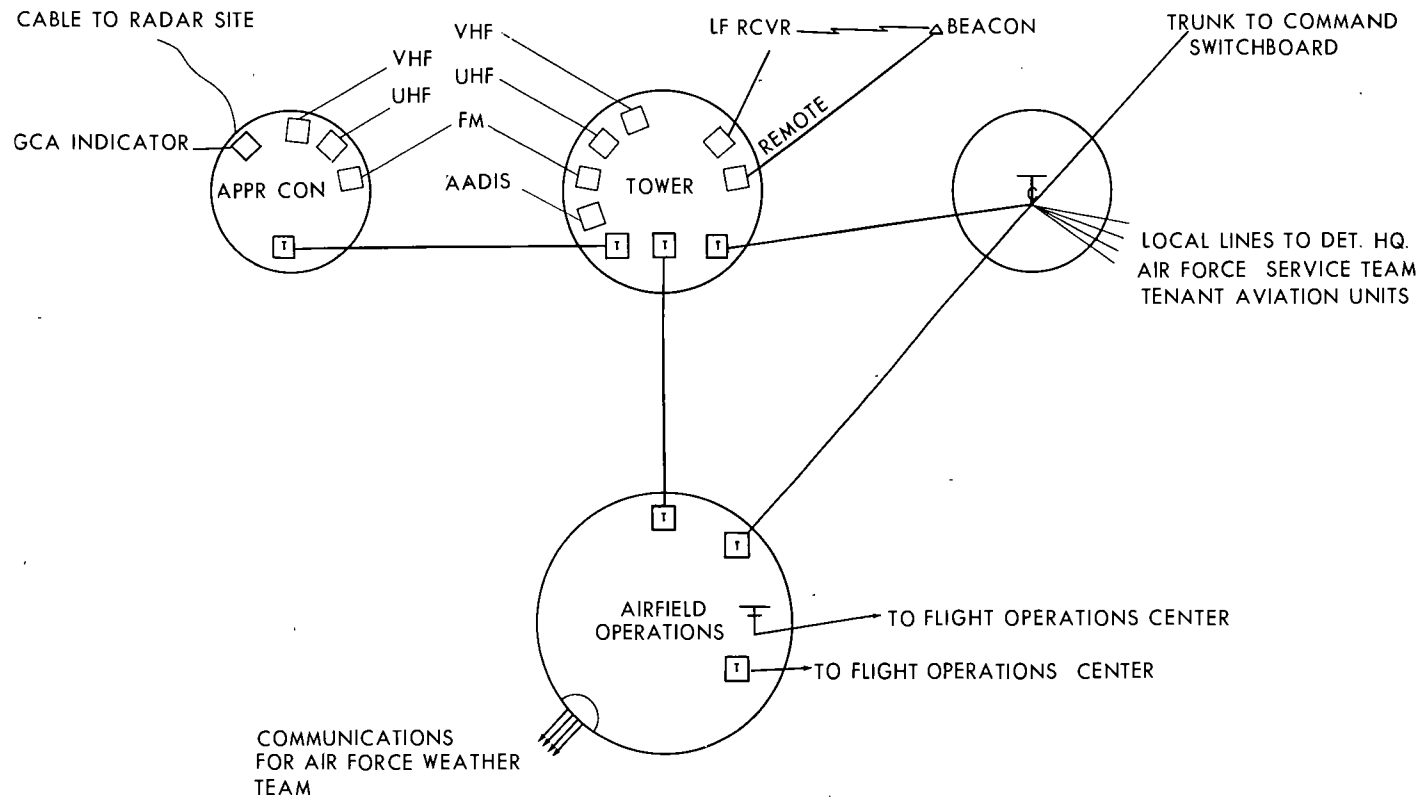


Figure 15. Typical airfield communications diagram.

Section IV. AIRFIELD AIR TRAFFIC OPERATIONS

65. Designation and Reporting Procedures

a. *Airfield Control Zones.* The commander responsible for Army air traffic operations is responsible for designating Army airfield control zones. The SOP of the command will outline the procedures for designating control zones when airfields are established. The commander is responsible for disseminating control zone and other flight information by appropriate expeditious means to insure Army-wide dissemination.

b. *Air Traffic Procedures.* The Army air traffic regulation system is described in chapter 2. The field army commander is responsible for publishing the information which establishes the type of approach and departure procedures, holding patterns, let-down procedures, and weather minimums for use within the army area of operations. Initial dissemination of these policies and procedures can be accomplished in aviation SOP's. Current changes caused by local operating conditions or displacement can best be accomplished by NOTAM messages transmitted over the Army communications network (app. II).

c. *LMF Beacon Operations.* Frequencies and code letters for LMF beacons within the field army will be published in SOI's and SOP's. Location, altitude, frequency, call sign, and complete instructions for ADF letdowns will be reported to the FOC by the most secure and rapid means possible. All malfunctions and breakdowns will be reported immediately by direct in-the-clear transmission to the FOC.

d. *Ground Control Approach Operations.* Frequencies and general operations instructions for GCA's within the field army will be published in SOI's and SOP's. Complete GCA radar procedures to include surveillance and precision approach letdown will be reported to the primary FOC by the most secure and rapid means possible. All malfunctions and breakdowns will be reported at once to the area FOC.

66. Air Controller Responsibility

The flight operations officer is responsible for the control of all air traffic within the airfield control zone and supervises all operating personnel in the tower and GCA approach facility. For each shift on duty in the airfield control tower, the flight operations officer will designate a chief or supervising controller who will be in charge of both tower and GCA operations and will act as the approach controller for the airfield during his tour of duty.

67. Airfield Traffic Control Procedures

This manual describes control of airfield traffic under IFR only.

Under IFR, the area FOC will clear aircraft to the low frequency beacon and down to control zone altitude. Once the aircraft has been turned over to airfield control, the approach controller will be responsible for the flight until a successful landing has been accomplished, or until the flight has been returned to the FOC for further action. Normal IFR approaches will be handled as follows:

- a. The pilot, when released to approach control, will report—
 - (1) Upon reaching the holding fix or point to which cleared, his position, time, and altitude.
 - (2) When vacating any assigned altitude.
 - (3) When leaving any assigned holding fix or point.
 - (4) When an approach has been missed, and request further clearance.
- b. The approach controller will—
 - (1) Acknowledge pilot's initial report over the holding fix, giving current ceiling, visibility, altimeter setting, time check, and further clearance such as new holding instructions and expected approach time if required.
 - (2) Clear aircraft for final approach and transmit any special reports required by local letdown procedures or traffic conditions. This clearance may direct a complete ADF letdown or any portion thereof, depending upon local SOP and/or conditions. If GCA is required, the pilot will be instructed to contact GCA on a specific frequency. The approach controller will immediately notify GCA of these instructions and turn control over to the radar approach controller.
 - (3) Upon notification of missed approach by the pilot, immediately notify the area FOC and instruct the flight to contact the center on the air traffic regulation frequency if appropriate (par. 29b). The exact procedure to be followed after any given missed approach will depend on local SOP and close coordination between the tower and the area FOC.
- c. Radar approaches will be accomplished as follows:
 - (1) Airfield traffic control approves ground controlled approach and alerts the GCA controller.
 - (2) The pilot will do exactly as the radar approach controller instructs, and if instructions cannot be followed, he will notify the controller immediately.
 - (3) If no transmission is received during any 1-minute period while in the GCA pattern, the pilot will accomplish the missed approach procedure for that particular airfield.
 - (4) When on the final approach, if no transmission is received during any 5-second period, the missed approach procedure will be followed and approach control will be

contacted for further instructions.

- (5) All headings and altitude instructions must be read back and all other transmissions acknowledged except when instructed otherwise by the radar controller.
- (6) When an aircraft has been cleared for a ground controlled approach, the GCA gives instructions to the pilot when radio contact is accomplished. These are the initial instructions to the pilot which enable him to enter the GCA pattern. The most common patterns used are the conventional rectangular pattern or a straight-in approach from the LMF beacon. In this case, the LMF radio beacon is used as the approach gate. Regardless of the pattern flown, the complete approach procedure is divided into four phases:
 - (a) *The initial approach.* This phase of the GCA pattern includes any holding or vectoring of aircraft prior to reaching the final approach phase. The airspeed during this portion of the pattern is one which the aircraft would normally use on the downwind and base leg during visual flight conditions. GCA gives the latest weather, the direction of landing, and the length of runway. The pilot performs the prelanding check when instructed by GCA.
 - (b) *The final approach.* This phase is that portion of the pattern 5 miles from the GCA and up to the point where the aircraft breaks through the overcast and visual reference to the ground is established by the pilot.
 - (c) *Prelanding.* The final approach controller continues to give instructions until the aircraft reaches the touchdown point. Since the transition from instrument flight to visual flight after breaking out of the overcast is the most difficult phase, the pilot continues to fly instruments and follows GCA instructions until the runway is clearly visible.
 - (d) *Touchdown and landing roll.* If there is no visual reference to the ground and the aircraft has reached GCA minimum altitude, the missed-approach procedure will be followed. If the ground is visible, a normal landing is accomplished.

68. Flight Plans—Airfield Operations—FOC Coordination

a. Flight plans will be filed at the airfield operations section of the airfield. The operations personnel assist the pilot in preparing and filing the flight plan, which is then submitted to the FOC for clearance. Necessary information on flight plans is also sub-

mitted to the tower. To expedite operations the pilot may prepare aircraft for takeoff and receive final FOC approval of clearance by radio from the airfield control tower when ready for takeoff. For security reasons, "Via flight plan route" clearances should be the only type permitted between towers and aircraft. If the clearance contains any change in the original request, the information will be given to the pilot by telephone at airfield operations or by an alert position located at the active runway and connected to the tower by wire.

b. When a flight plan must be initiated after takeoff, the pilot may file the flight plan by radio directly to the FOC. Under no circumstances will the aircraft enter areas requiring flight clearance prior to receipt of clearance from the FOC.

c. Closing of flight plans is the responsibility of the pilot in command of the aircraft. For example, although SOP's may permit the airfield tower to close the flight plan with FOC, the pilot is personally responsible for insuring that his flight plan is closed. He may close the flight plan from the air by radio after he has completely cleared the conditions (weather, air defense restrictions, or area) that required him to be under controlled clearance. Under no condition will the pilot cancel or close his flight plan until the completion of these imposed requirements.

69. Weather Briefings

Weather briefings will be available to the pilot at airfield operations, with direct contact between pilot and forecaster being provided. Normally, the Air Force air weather service team will be located either in or adjacent to the airfield operations installation; however, if this team is located at some other place, sole user telephone circuits must be available for pilot-weather forecaster service.

Section V. FLIGHT OPERATIONS CENTER (FOC)—GENERAL

70. General

a. The FOC is the primary agency of the Army air traffic regulation system, and is established in each corps, army, and, when required, communications zone. It is under the staff supervision of the aviation officer of the headquarters to which assigned. The FOC accomplishes the planning, coordination, administration, and communications necessary for aircraft identification and the continuous operation of the Army air traffic regulation system. Normally, the FOC will be adjacent to the AADCP in assigned zone of responsibility; however, during planned displacements, alternate or adjacent FOC's will take over regulation of air traffic in

a manner similar to that utilized by AADCP's during movement of its elements (transfer of traffic prior to actual move).

b. Each FOC has a designated area of responsibility. The FOC is responsible for regulation of airborne aircraft within its area excluding airfield control zones. FOC areas of responsibility are given in paragraph 21. Normally, field army FOC will regulate the air routes entering corps area from the army service area forward to the first navigational aid on these routes.

c. The flight operations center is a mobile unit containing sufficient personnel and equipment to perform its assigned missions.

71. Functions

The flight operations center provides air traffic regulation, warning, air defense identification, and inflight assistance in its assigned area of responsibility in accordance with the policy of the major command concerned. To accomplish this, the FOC—

a. Receives and provides clearance for proposed IFR flight plans originating in or entering its assigned area of responsibility.

b. Provides en route air traffic regulation within its area of responsibility.

c. Provides air defense identification of Army aircraft to the AADCP and other agencies as required.

d. Receives and disseminates air warnings to include use of VT fuze, nuclear weapons, and enemy action both in the air and on the ground.

e. Receives, consolidates, and retransmits weather reports.

f. Receives, consolidates, issues, and relays NOTAMS.

g. Disseminates pertinent directives, information, and policies to airfields in areas as prescribed by the aviation officer of the headquarters to which assigned.

h. Provides emergency inflight assistance to aircraft.

i. Transmits warning of hazardous weather conditions.

j. Compiles and furnishes planning data to the aviation officer.

k. Maintains a current status chart of all navigational and traffic regulation facilities in the area to which assigned.

72. Search and Rescue Procedure

The FOC has neither direct nor indirect control of search and rescue facilities; therefore its search and rescue responsibilities are limited to furnishing necessary information to and alerting the controlling agencies. Air search and rescue units will be designated by the major unit commander concerned.

a. The FOC serves as the central point for the coordination of flight data and the dissemination of aircraft movement information regarding air traffic within its sector of responsibility.

b. The FOC provides search and rescue information to assist the associated air rescue agency by advising aircraft believed, or known to be, in need of rescue assistance. In addition, the FOC will supply pertinent information concerning last known position, estimated present position, radius of possible action, and position of other aircraft along the route of flight. The FOC will act as a clearing agency for assembling all necessary data.

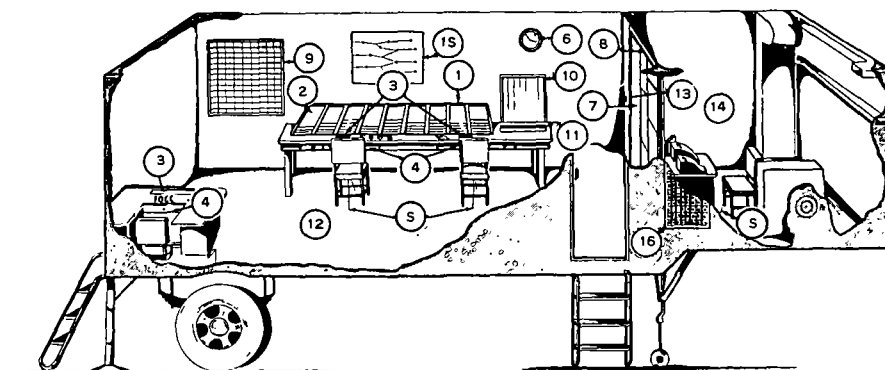
Section VI. FOC EQUIPMENT REQUIREMENTS AND APPLICATIONS

73. General

The FOC may operate from a flight operation central mounted in a van (fig. 16) or operated from a tent or building as shown in figure 17.

74. Aircraft Plotting Board

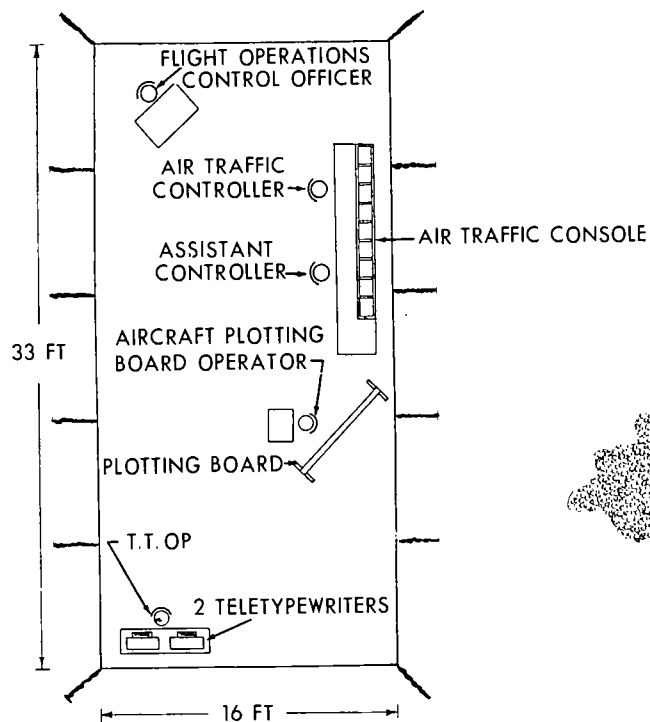
a. *Description.* The aircraft plotting board (fig. 18) is designed to present to FOC a continuous picture of the air traffic situation as indicated by aircraft symbols placed on the board. It is a vertical board, the size of which will be determined by the area to



NOTES:

1. AIRCRAFT TRAFFIC CONSOLE
2. STORAGE CHUTES FOR EXTRA FLIGHT PROGRESS STRIP HOLOGERS
3. COMMUNICATIONS CONTROL PANEL
4. DRAWERS
5. QUICK RELEASE TIE DOWNS
6. CLOCK
7. AIRCRAFT PLOTTING BOARD
8. CLEAR PLASTIC OVERLAY FOR GEOREF GRID
9. NAVIGATIONAL FACILITIES STATUS BOARD
10. MAGNET SYMBOL FILING BOARD
11. ALTITUDE ARROW FILING BOX
12. OPERATING AREA
13. SLIDING DOOR
14. EQUIPMENT AREA
15. AIR ROUTE CHART (LINE DRAWING)
16. AIR VENT

Figure 16. FOC operation in FOC van.



AM RADIOS-AN/GRC TYPE
 FM RADIOS-AN/VRC SERIES
 VHF RADIOS-AN/ARC SERIES
 UHF RADIOS-AN/ARC SERIES

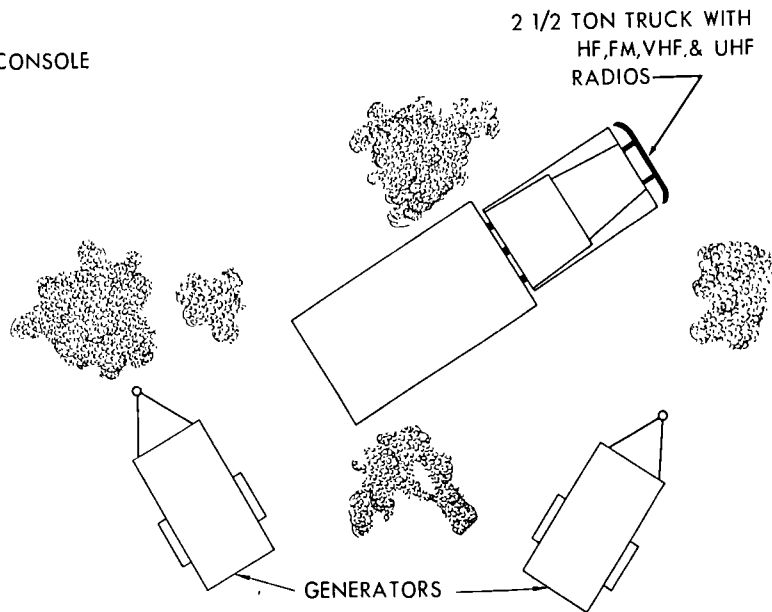


Figure 17. FOC operation in GP tent.

be displayed and the scale of the map to be used. A board six feet square provides a mounting surface with a map scale of 1:100,000 for an area 100 miles in width and 100 miles in depth. The scale of the maps used on the aircraft plotting board will vary with the tactical situation, desires of the commander, and availability of maps. However, the scale should, if possible, permit coverage of the entire field army area.

b. Essential Data. Essential data to be displayed will vary with the situation and operating personnel. Minimum data to be included are—

- (1) Track symbols indicating altitude, direction of flight, type of aircraft, and identification to be placed on last reported fix of all airborne aircraft. Refer to *d* below for detailed description.
- (2) Major airfields to include divisions. The field army and corps base airfields will have a compass rose plotted around the perimeter of their control zones.
- (3) All designated air routes.
- (4) All areas restricted to flight.
- (5) Other FOC's.
- (6) All navigational facilities.
- (7) Tactical boundaries of major units.
- (8) Planned track of IFR flights off air routes (point-to-point flights).

Note. In addition, a movable transparent overlay described in *c*(2) below will include that portion of the Georef grid that is covered by the plotting board and the surveillance mode coverage of the GCA radars at division, corps, and army airfields.

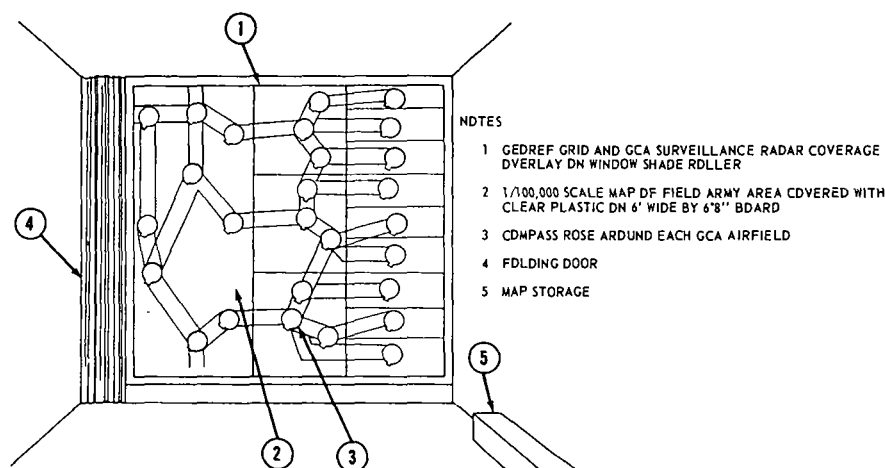


Figure 18. Aircraft plotting board.

c. *Components.*

- (1) The board should be covered with a steel mesh (screen) which will permit the concurrent use of magnetic symbols and tacks or staples. The map on the board should be covered with a transparent plastic to permit marking with a china marking pencil.
- (2) An additional transparent overlay should be furnished with this board to provide for the use of the world geographic reference system (Georef), which is used by the AADCP. For further information concerning this grid system, see TM 6-200. This overlay (fig. 19) should be movable to allow rapid replacement on the board when exchange of grid coordinates is made within the AADCP-FOC team.

d. *Use of Magnetic Track Symbols.* The aircraft plotting board operator will use movable magnetic track symbols to indicate information.

- (1) Altitude and direction of flight will be indicated by color-coded arrows which are interchangeable.

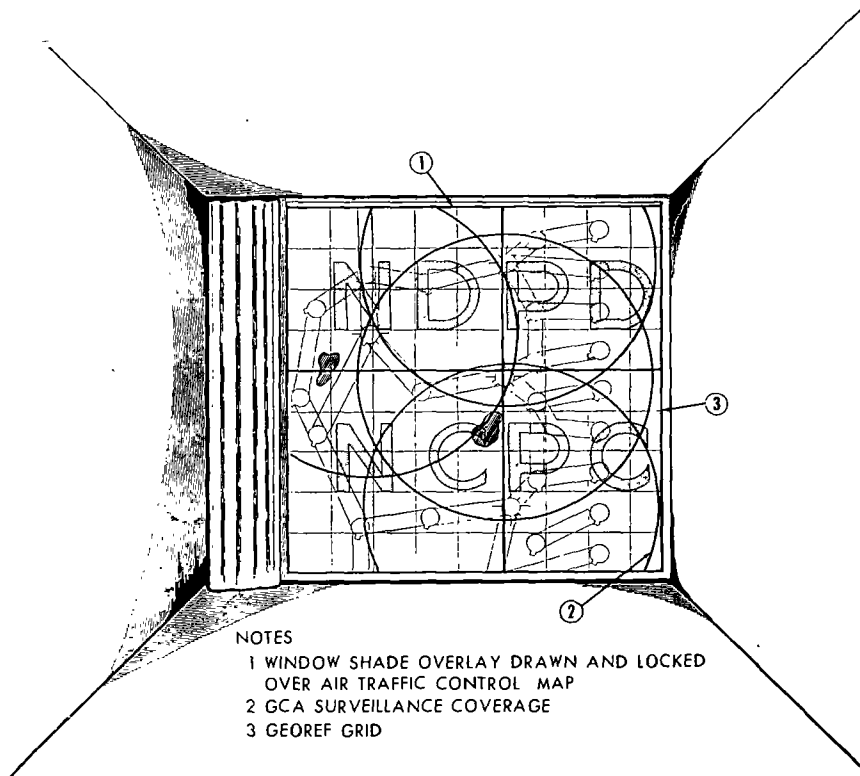


Figure 19. Air defense grid overlay for FOC aircraft plotting board.

- (2) Type of aircraft and cruising speed will be shown by the shape of the symbol.
- (3) Identification of the flight will be indicated in china marking pencil on the plastic face of the symbol by a numeral or letter which is keyed to the full flight plan on the aircraft traffic console.
- (4) A code number or letter designating the radio frequencies available in the aircraft will also be marked upon the plastic face of the symbol.

75. Aircraft Traffic Console

Design of the aircraft traffic console (fig. 20) allows the air traffic controller to maintain a constantly changing reference to all IFR flight plans and the current status of each flight. The console is used by the controller to determine whether a flight can be cleared to a given point, over a given route, and at a certain time and altitude. It is also the source of information pertaining to the identification of each flight which is placed on the plotting board. The console consists of a bank of inclined racks of a size which will accommodate movable holders for flight progress strips. The number of racks is determined by the estimated peak traffic load and number of reporting points in a field army zone.

76. Flight Progress Strip Holders

Flight progress strip holders are designed for easy insertion and removal of flight progress strips (fig. 21). These holders are shaped to fit in the racks of the aircraft traffic console, so that a holder may be moved up and down in the rack, or from rack to rack, as flight of an aircraft progresses from reporting point to reporting point.

77. Fix Designator Holders

Fix designator holders are designed to hold a card showing the name and code designator of particular navigational aids. These holders differ from the flight progress strip holder only in that they are constructed to fasten in any desired position on the traffic console.

78. Navigational Facilities Status Board

The navigational facilities status board (fig. 22) is a chart or chalk board for noting the current status of all navigational aids within the FOC area of responsibility. By using an overprinted chalk board or an acetate-covered chart, frequent changing of data on the status board is facilitated. The minimum information charted should include—

- a. Operational status of all LMF beacons.
- b. Operational status of GCA radar facilities.

1. MAGNETIC SYMBOL FILE BOARD
2. ALTITUDE ARROW FILE BOX
3. CONTROL PANEL

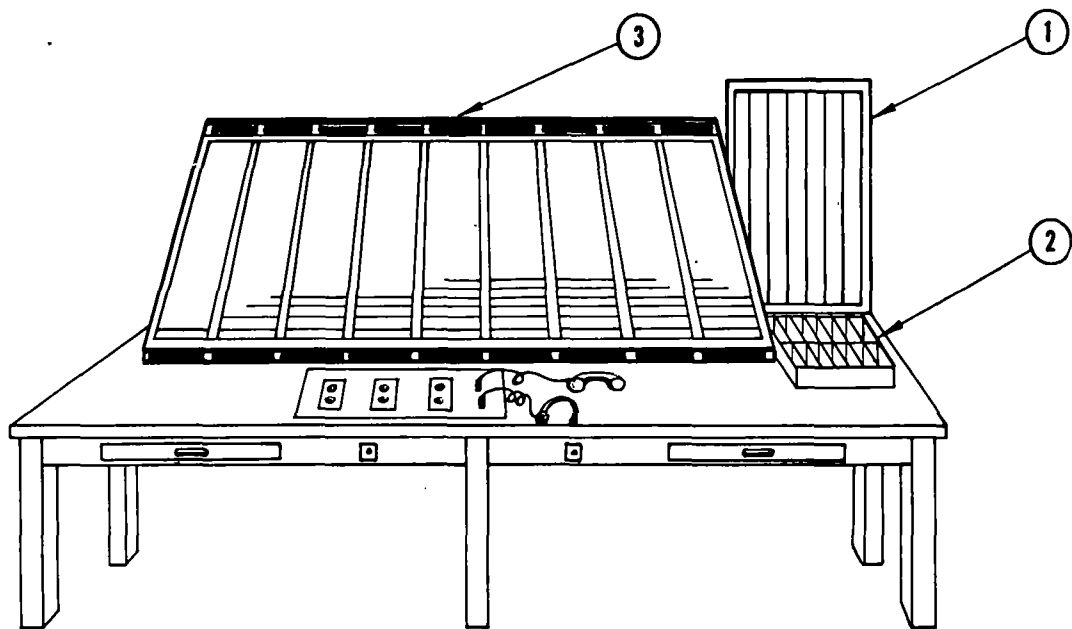


Figure 20. Aircraft traffic console.

- c. Assigned frequency of all beacons.
- d. Code designator of all beacons.
- e. Operational status and assigned frequency of traffic control radios.
- f. Coordinates of beacons.
- g. ADF letdown patterns and procedures for each airfield beacon.
- h. Airfield size, elevation, and surface conditions.

79. Communications Equipment

For communications equipment and systems, see paragraphs 93 through 96.

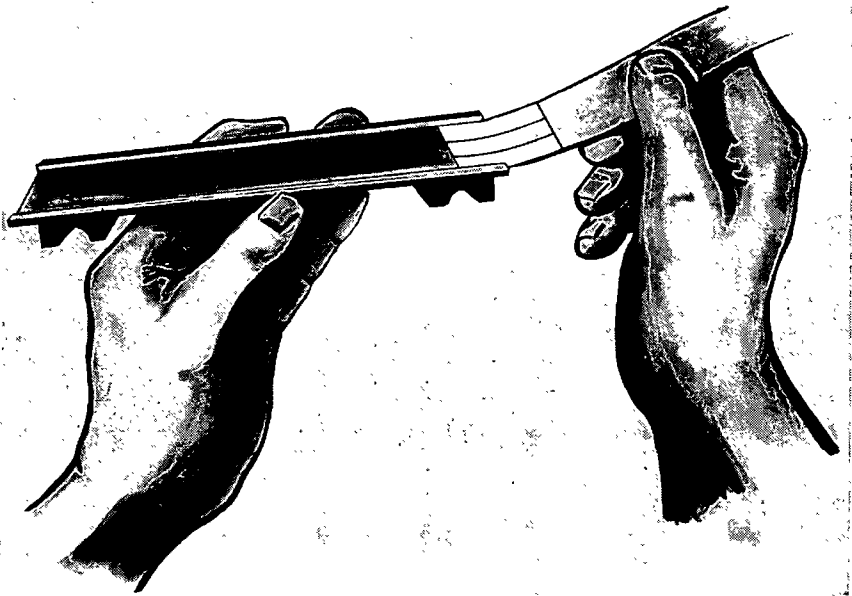


Figure 21. Flight progress strip and holder.

CODE NAME DESIGNATOR	MASTER	MURDER	CHEWER
	MMM	MDD	CCC
GCA	OP 122.1-231.1	INOP 1208-242.7	OP 126
UHF AN/ARC SERIES	OP 244.4	OP 238.6	OP 2
VHF AN/ARC SERIES	INOP 122.5	OP 121.7	OP
FM AN/VRC SERIES	OP 32.3	OP 38.7	OP
HOMER	OP 381 KC	OP 312 KC	OP
AH	2200 FT	1900	
AL	800 FT	700	
BC	138°	23	
DR	2.3 NM	3.1	
RF	UHF - FM OPERATING		
FE	400		
BI	98°		
KA	621.41 - 818		
KB	625.50 - 82		
TURN	LEFT		
MA	650 FT		
MW	200 - 1/2		
DT	1.5 MIN		
AT	1400 FT		

Figure 22. Navigational facilities status board.

Section VII. LOCATION, PHYSICAL ARRANGEMENT, AND DISPLACEMENT

80. General

Since the primary functions of the FOC require continuous coordination with the AADCP to permit rapid and constant exchange of information by direct communications, the center is ideally located adjacent to the AADCP. If the FOC is operated from the mobile van no additional equipment is necessary as all equipment is installed and placed to expedite its appropriate function. If the center is required to operate in some other shelter, the necessary portable equipment of the same type must be provided and the positions arranged generally as shown in figure 23.

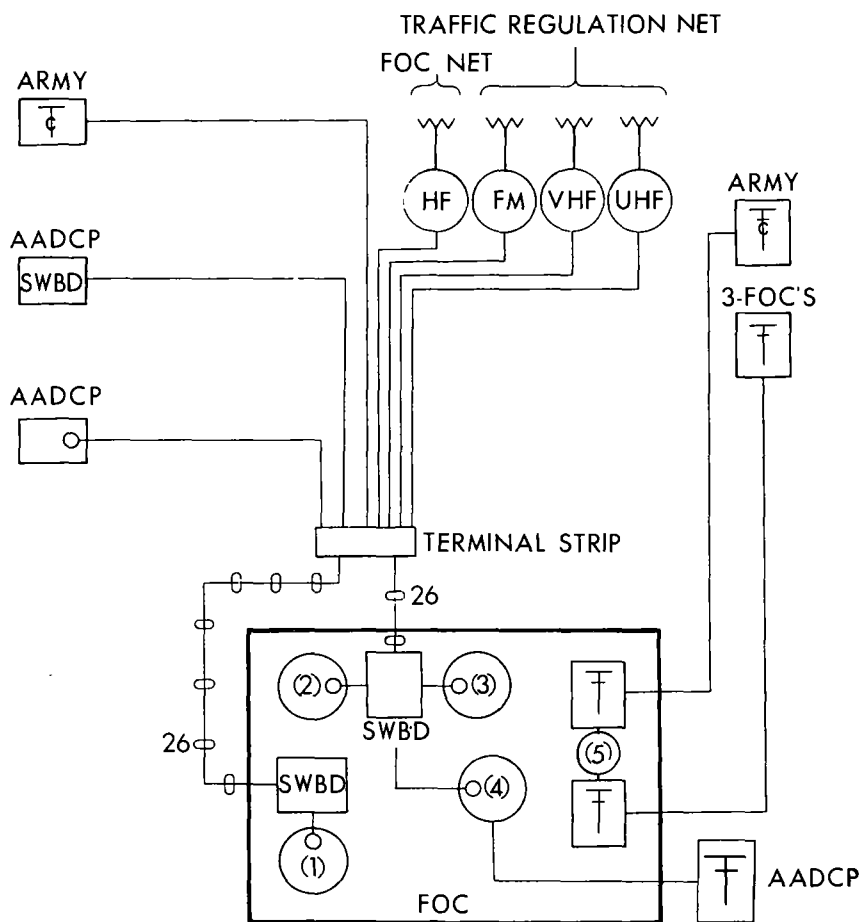
81. Displacement

a. The FOC displaces when the AADCP displaces and to the same general location.

b. Prior to displacement, the FOC commander coordinates with AADCP by insuring that a member of the FOC accompanies the air defense unit reconnaissance party to the new location.

c. During displacement, the traffic regulation and identification responsibility of the FOC will be assumed by an alternate FOC or one of the other FOC-AADCP teams within the field army. This transfer of responsibility should be accomplished on a time schedule to insure continuous operation of the Army air traffic regulation system. Transfer of air traffic regulation responsibility to another FOC will require coordination with air defense forces of the area so that specific area air defense and air traffic regulation responsibilities will be transferred to the same FOC-AADCP team.

d. Each FOC monitors flights in the airways adjacent to its primary area of responsibility. Thus, a secondary controlling agency is always ready to assume control of the functions of the monitored FOC during an emergency or displacement. Flight progress strips (identified by different colors) are used to record all flights. The upper portion of the traffic console contains flight strips which record monitored flights, while the lower portion of the console contains flight strips which record traffic flow in the primary area (fig. 24). The primary FOC forwards current flight positions to the monitoring FOC by direct telephone line as position reports are received within its sector. Pilots must be briefed on the assigned frequencies of the monitoring FOC before departure from base airfields to enable them to establish communications if the need arises.



- (1) FLIGHT OPERATIONS CONTROL OFFICER
- (2) AIR TRAFFIC CONTROLLER
- (3) ASSISTANT CONTROLLERS
- (4) AIRCRAFT PLOTTING BOARD OPERATOR
- (5) TELETYPE OPERATOR

Figure 23. FOC communications diagram.

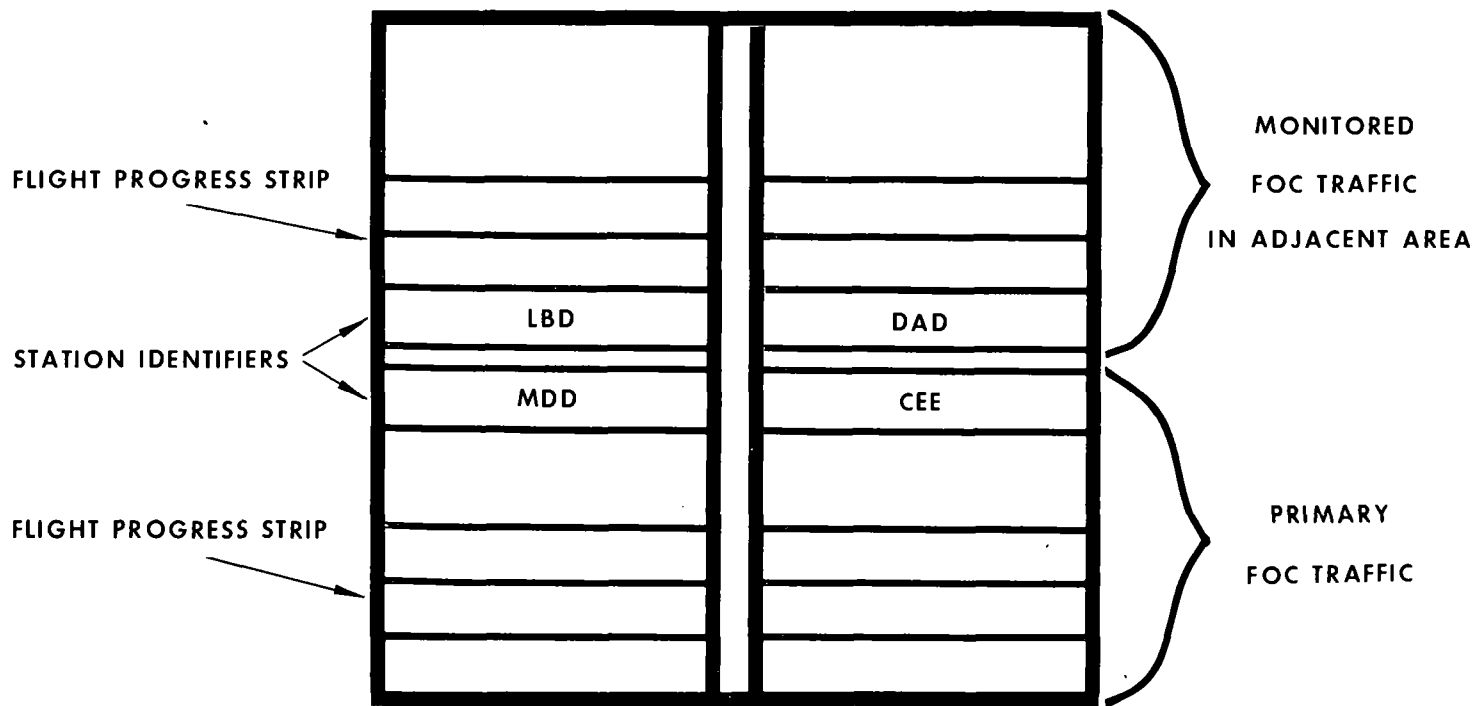


Figure 24. Portion of console showing traffic flow.

Section VIII. OPERATING TECHNIQUES

82. General

Specific techniques of operation within the FOC will vary with the situation. The methods below should serve as a guide. Detailed coverage of procedures in the control of IFR traffic and other functions of the FOC are contained in appendix V.

83. Designation and Reporting

Designation and reporting of air routes, control zones, and IFR flight data are as follows:

a. The field army FOC will, under the supervision of the field army aviation officer, act as the agency for designation and reporting of all data pertaining to primary air routes, airfield locations, beacon locations, traffic patterns, instrument holding patterns, letdown procedures, and IFR minimums to airfields and FOC's. This will be accomplished as follows:

- (1) Reports of airfield locations, altitudes and other pertinent data, traffic patterns, instrument holding patterns, instrument letdown patterns, missed approach procedures, and IFR minimums will be forwarded by airfield commanders to the army FOC through the most direct and secure communications facilities available. These reports will normally be sent by teletype or telephone.
- (2) As the reports outlined in (1) above are received in the FOC, the aircraft plotting board operator will locate and plot on the plotting board the exact locations of airfields and beacons, and will post the remaining information on the facilities status board.
- (3) When sufficient beacon locations have been plotted for planning purposes, the FOC will, if accurately contoured maps are available and after a detailed map reconnaissance, plot tentative air routes and minimum altitudes. During this phase, close coordination with the AADCP is mandatory to insure that all areas restricted to flight are plotted. This will preclude the possibility of designating an air route which crosses a restricted area.
- (4) When time is available or accurately contoured maps are *not* available, the FOC will request VFR aerial reconnaissance of the proposed route to determine obstacles to flight and the appropriate minimum altitude to be designated.
- (5) When air routes have been chosen and minimum altitudes assigned, the FOC (utilizing the teletypewriter nets) will transmit the information to all corps FOC's and all air-

fields. Information will be disseminated as outlined in appendix II.

- (6) Upon receipt of the above data, the corps FOC may designate secondary air routes. If this is done, the Army FOC must be notified.

b. The complete procedure as outlined above will seldom be applicable. Normally, the airfields within the corps and divisions will displace individually and at different times. Therefore, new air routes will normally be extensions of existing air routes, and a reconnaissance flight under VFR conditions will have been flown prior to emplacement of the beacons.

84. Flight Plans

a. Flight plans (par. 12) are received in the FOC by the air traffic controller or his assistant and recorded directly on a flight progress strip. The flight plan is normally received from airfield operations or the adjacent FOC by the direct telephone circuit. In the event of wire communication failure or the departure of an aircraft from a location without installed communications equipment, an abbreviated flight plan may be received directly at the FOC on the air traffic regulation channel after the flight is airborne.

b. IFR flight plans received in the FOC will be processed as follows:

- (1) Flight plan will be checked by the assistant air traffic controller for completeness of data as outlined in paragraph 12.
- (2) Air traffic controller will check the proposed flight plan against all flight progress strips currently on the traffic console to insure inflight separation.
- (3) When a flight involves a proposed flight in another control area, the air traffic controller or assistant will contact the FOC's concerned to obtain necessary clearance.
- (4) After the air traffic controller has determined the flight clearance to include altitude, route, and departure time from point of departure to final destination, he will issue a flight clearance to the originator of the flight plan and the designated adjacent FOC by direct telephone circuit.
- (5) The traffic controller will place a flight progress strip showing necessary data (app. V) under the first fix designator to be crossed by the flight in the primary control area and over the appropriate fix designator in the adjacent FOC area if it is a monitored flight.
- (6) The new flight is placed on the aircraft plotting board by the plotting board operator.

(7) Destination airfield is notified by the air traffic controller or assistant.

c. The FOC will forward flight plans as follows:

(1) Pertinent portions of the flight plan will be transmitted to the AADCP and designated adjacent FOC by the flight operations control officer. Information furnished will include—

- (a) Number of aircraft in flight.
- (b) Route or track to be flown.
- (c) Departure time.
- (d) Estimated time en route.
- (e) Estimated time of flight termination.
- (f) Altitude.

(2) When a flight plan proposes a flight out of the army area, the flight operations control officer will coordinate with the appropriate FOC or agencies of other Services as required.

d. Upon notification from the aircraft or from the arrival airfield of the termination of a flight, the following will be accomplished within the FOC:

- (1) The air traffic controller or assistant will remove and file the appropriate flight progress strip from the traffic console.
- (2) The aircraft plotting board operator will remove the appropriate flight symbol from the plotting board.
- (3) The flight operations officer will notify the AADCP and the designated adjacent FOC of the termination of the flight.
- (4) The departure airfield will be notified by the air traffic controller or his assistant.

85. En Route Flight Control

During IFR flight of an aircraft within the assigned area of responsibility, the following is accomplished with the FOC:

a. Changes in flight plans which are received from inflight aircraft by radio are processed by the air traffic controller in the same manner as prescribed for initial flight plans.

b. Position reports of inflight aircraft are received by radio and logged on the flight progress strips by the air traffic controller. These progress reports are then forwarded to the adjacent FOC having monitoring responsibilities, for the purpose of updating their traffic console.

c. Aircraft plotting symbols are placed on the plotting board at the last reported fix.

d. Air traffic is adjusted by the air traffic controller, in accordance with latest position reports or inflight changes to flight plans.

This information is also transferred to the adjacent FOC as required.

86. Altitude and Flight Priority

The FOC will control the issuance of flight clearances to conform to existing directives concerning altitude assignment (par. 16). Priority will be given specific flights in accordance with the policies of the commander of the headquarters to which assigned.

87. Flight Separation

a. The FOC is responsible for accomplishing the necessary separation (par. 15). This will be effected primarily through the controlled issuance of flight clearances and the approval or disapproval of inflight changes by the air traffic controller.

b. The air traffic controller will, upon receipt of a flight plan, check the proposed plan against all flights by comparing the proposed flight plan data with all flight progress strips located on the air traffic console. The controller will maintain a continuous cross-check of all flights in progress, and when necessary issue new instructions or change existing clearance to insure prescribed separations at all times. (Detailed procedures are contained in appendix V.)

c. The flight operations control officer will maintain close supervision over the air traffic controller and will spot check the air traffic console frequently to insure proper separation.

88. Weather Service

The FOC will furnish weather service to aircraft and airfields. Warnings of weather conditions hazardous to flight will be transmitted immediately to all airborne aircraft by the air traffic controller utilizing the air traffic regulation net. Routine and emergency weather reports received from weather teams located at corps or army airfields will be utilized for this purpose.

89. Receipt and Transmission of Air Warnings

Hostile air warnings are received by the FOCO directly from the AADCP by direct telephone circuit. An immediate relay of this information, edited as necessary, will be transmitted by the FOCO over the air traffic regulation net to all inflight aircraft (air warning net when available).

90. Air Defense Identification

Identification and air defense operations are accomplished within the FOC as follows:

a. The AADCP is advised of all area aircraft operations by the plotting board operator or the FOCO.

b. The FOCO, upon request from AADCP, will verify or identify flights in progress by track verification through direct communication with aircraft or, in an emergency, cause the aircraft in question to fly an identifying pattern.

c. If enemy flights are discovered in the same area as friendly IFR traffic, the FOCO will transmit an immediate change of flight orders to friendly aircraft, thus isolating the enemy aircraft for air defense action.

91. Hostile Air Reports

When reports of hostile air activity are received from Army aircraft, the flight operations control officer will immediately notify the AADCP.

92. Emergency Inflight Assistance

The FOC provides emergency inflight assistance if an aircraft is lost and requests assistance. The flight operations control officer will—

a. Determine the general position area of the aircraft by reference to flight plan data and last known position.

b. Request a radar position fix from the AADCP or through its facilities from radar of other services.

c. If necessary, by direct communication over air traffic regulation channel, cause lost aircraft to fly an identifying pattern to facilitate radar acquisition.

d. When the position of the aircraft is plotted on the AADCP board, cause the aircraft plotting board operator to visually transpose the plot of the aircraft position to the FOC plotting board, and plot a course with a straightedge to the nearest Army airfield having GCA facilities.

e. Determine, from plotted data and known airspeed, the distance, direction, and time the aircraft must fly to arrive at airfield with radar facilities.

f. Transmit vector data (no position data) directly to the aircraft using the air traffic regulation channel.

g. Notify destination airfield of incoming aircraft and request notification of GCA radar acquisition.

h. Cause the air traffic controller to check flights in progress and insure separation for vectored aircraft in distress.

i. Notify AADCP of action taken and the course the aircraft is to fly.

j. Notify original destination airfield of the new flight data.

k. If necessary, request subsequent plot by AADCP so that wind drift correction can be computed and transmitted to the aircraft.

Section IX. FOC COMMUNICATIONS

93. General

Dependable communication is the most important factor in the successful operation of the FOC and the Army's tactical air traffic regulation system. All personnel assigned to the flight operations center must be thoroughly trained in communication operations and maintenance since they are required to be communications operators in addition to their other duties. Since effective communication is vital to combat effectiveness, the FOC commander should have alternate means of communication installed, as soon as possible, to meet every requirement. Communications available to the FOC include radio and wire, utilizing both telephone and teletypewriter.

94. Ground-to-Ground Communications

Ground-to-ground communications utilized by aviation units include both telephone and voice-frequency teletypewriter. The commander of the major command or supported command is responsible for having appropriate signal troops install telephone and teletypewriter trunks to Army aviation installations. Local wire circuits are established by the communications personnel of the detachment. The extent of the wire system depends on the length of time and the means available. Wire systems are expanded and improved by additional circuits, as the situation permits, until complete ground-to-ground communications are available.

a. Telephone Communications. Telephone circuits required in Army air traffic tactical operations are as follows (fig. 5 and par. 12):

- (1) Circuits between FOC and airfields within its area of responsibility. (Sole user telephone and voice-frequency teletypewriter circuits will be the normal requirement.)
- (2) Circuits between all FOC's within the field army. (Sole user telephone and voice-frequency teletypewriter circuits will be the normal requirement.)
- (3) Direct circuit between the FOC and AADCP.
- (4) Trunk from the FOC to the command switching system which provides an allocated (direct) circuit to each FOC and to each airfield from the appropriate FOC.
- (5) Trunk from each airfield to the command switching system.

b. Teletypewriter Communications. Voice-frequency teletypewriter circuits required in Army air traffic tactical operations are as follows (fig. 6 and par. 12):

- (1) Teletypewriter net between FOC's in the field army pro-

vided by circuits allocated in the area communication system.

- (2) Allocated (direct) teletypewriter circuits from airfields to appropriate FOC's provided by the area communications system.

Note. FOC teletypewriter nets should include reperforator transmitter equipment to increase speed and accuracy of transmissions.

95. Communication Nets

FOC communication nets include the following:

a. Air Traffic Regulation Net. This net is established using UHF or VHF primarily, but may use VHF FM as an alternate means. It connects each FOC with all aircraft operating within its area of responsibility.

b. FOC Net. This is a radio net connecting all FOC's in the field army area.

c. FOC Teletypewriter Net. This is a voice-frequency teletypewriter net connecting all FOC's in the field army area.

d. FOC Wire Net. This is a sole user telephone net connecting all FOC's through allocated circuits in the area communication system.

e. Operations Net. This is a telephone net which connects all airfields in the area of responsibility with the FOC and is used primarily for the exchange of flight plans and clearance.

f. Teletypewriter Operation Net. This is a sole user teletypewriter net which individually connects all airfields in the area of responsibility with the FOC and is used primarily for transmission of NOTAMS, weather, and pertinent directives, information, and policies prescribed by the appropriate commanders.

g. AADCP-FOC Liaison Net. This consists of telephone circuits connecting FOC's with colocated AADCP's.

h. Supplemental Communications. Supplementary communications are provided through the Army area communications system. Each FOC will be connected to the nearest switching center in the system thereby enabling it to communicate with other common users of the system.

96. Installation of Communications

Installation of FOC communications (fig. 23) will vary somewhat with exact location of the center and the desires of the commander. However, the following requirements exist in every situation:

a. Radios with antennas should be located away from the immediate vicinity of the center. This will tend to make the exact location of the center less conspicuous.

b. Power sources should be located away from the center to reduce the noise level.

c. Teletypewriters should be located so that a wall or other noise-reducing barrier is placed between the machines and operating positions in the center.

d. One switching panel will be installed at operating position (1) and one between positions (2) and (3).

e. Each of the air traffic regulation radios will be connected to loudspeakers, which by position or sound level will enable personnel at any of the operating positions to monitor the radios and determine from which radio a transmission is being received.

APPENDIX I

REFERENCES

AR 220-70	Companies; General Provisions
AR 320-5	Dictionary of United States Army Terms
AR 320-50	Authorized Abbreviations and Brevity Codes
AR 611-201	Manual of Enlisted Military Occupational Specialties.
DA Pam 108-1	Index of Army Motion Pictures, Film Strips, Slides, and Phono-recordings.
FM 1-5	Army Aviation Organizations and Employment.
FM 1-100	Army Aviation
FM 11-16	Signal Orders, Records, and Reports
FM 21-5	Military Training
FM 21-6	Techniques of Military Instruction
FM 21-30	Military Symbols
FM 24-20	Field Wire and Field Cable Techniques
FM 44-1	Aircraft Artillery Employment
FM 44-8	Army Air Defense Command Post and Army Air Defense Information Service.
TM 1-215	Altitude Instrument Flying
TM 1-225	Navigation for Army Aviation
TM 6-200	Artillery Survey
TM 11-2557-27	ANC Procedures for the Control of Air Traffic
TM 11-2557-28	United States Standard Manual of Radar Air Traffic Control Procedures.
TM 11-5550	Operations Centers AN/MTQ-1, AN/MTQ-1A, and AN/MTQ-1B.
TOE 1-127	Corps Aviation Company
TOE 1-137	Army Aviation Company
TOE 1-207	Army Aviation Operating Detachment
ACP 165	*Operational Brevity Codes (U)

*Indexed in (C) JANAP 201.

APPENDIX II

METHOD OF DISSEMINATING FLIGHT INFORMATION

Section I. GENERAL

1. Purpose and Scope

This appendix is a guide for Army aviation personnel in preparing and disseminating air traffic tactical operations data. It covers a method for the collection, consolidation, and transmission of all necessary information on airfields, navigation aids, air routes, control zones, and en route and terminal control procedures. The method contained in this appendix is intended as a guide only and should be modified to fit local SOP's and directives.

2. Responsibilities

The theater or task force commander is responsible for regulations governing the control of the airspace within his area of interest. The field army commander in turn is given the responsibility for controlling the airspace above his field army, and throughout his area of interest. The field army aviation staff officer will, by utilizing FOC's, set up and operate the field army air traffic tactical operations system.

Section II. METHOD OF OPERATION

3. Reports

Upon establishing an airfield, the responsible aviation officer or aviation unit commander will forward by the most expeditious and secure means available (normally by teletypewriter), to the field army flight operations center, the following information:

- a.* ADF letdown (par. 7).
- b.* GCA status and letdown procedures (if airfield is so equipped).
- c.* Coordinates, altitude, and general description of airfield and surrounding area, to include obstacles to flight.
- d.* Coordinates, altitude, and general description of LMF beacon installation and surrounding area, to include obstacles to flight.
- e.* Control zone information and requirements. The size and shape of the airfield control zones will normally be standardized. However, each airfield commander will submit recommended deviations when necessary.
- f.* Location of any known airspace restricted areas.

g. General remarks to include IFR minimums, traffic patterns, frequencies, prevailing wind, aircraft parking and service information, recommended minimum altitude, and location of Army air routes within the reported area.

4. Consolidation and Designation

The field army FOC, under supervision of the field army aviation officer, will consolidate and record all information received. All beacons and airfields will be plotted and the primary air routes sketched in. The AADCP will furnish information relative to air defense restricted areas. Contoured maps, local area reports, and VFR reconnaissance flights will be utilized to determine the final location and minimum altitudes for the primary air routes.

5. Dissemination

a. Standard procedures and messages will be utilized to disseminate all air traffic tactical operational information. All aviation personnel must become completely familiar with the SOP's governing original and subsequent changes to air traffic methods and procedures (NOTAMS). Standardization of all en route and terminal facilities, control routes and zones, and procedures within the command (to include ADF and GCA letdowns) may be accomplished by utilizing a prearranged type of brevity code (par. 7). This code may be used to transmit reports and changes to the field army FOC and to disseminate the complete, approved air traffic system and necessary day-to-day changes to all aviation users.

b. When appropriate, dissemination of the above type information, to include data for adjacent field army areas and/or for the Communications Zone, may be accomplished by means of pertinent SOI's.

6. Standard Air Traffic Manuals

Standard en route and terminal letdown manuals of local manufacture should be available at all airfields. These manuals may be prepared according to local SOP. However, they must be designed to facilitate recording the latest flight data. One method of accomplishment would be a book of plastic or acetate pages. Certain of the pages should form envelopes capable of containing map sections of the area. The primary air routes can then be drawn on the plastic or acetate covering so that changes can be made as necessary. Blank schematic diagrams of standard patterns and letdowns could be permanently inscribed on the remaining pages, thus allowing addition of the latest data on these procedures for the area of operations.

7. Standard Patterns and Procedures

Although all traffic patterns and letdowns can be diagrammed,

coded, and standardized, this paragraph contains a suggested system for the ADF letdown and the air route system only.

a. ADF Letdown and Air Route Codes.

Code	Designation
AC	Approach control.
AH	Altitude initial or high cone (mean sea level).
AL	Altitude low cone (mean sea level).
AM	Altitude, minimum en route (mean sea level).
AT	Procedure turn altitude (mean sea level).
BC	Bearing for climbout on missed approach (from beacon).
BI	Bearing inbound (magnetic).
CO	Course outbound (outbound bearing and code letters of the next beacon or fix). (The application of the outbound bearing of the next station will allow designation of air routes that do not necessarily constitute straight lines between beacons.)
DR	Distance to next fix (beacon) (nautical miles).
DT	Distance beacon to runway (in tenths of nautical mile).
FE	Procedure turn distance and/or time from beacon.
DF	Field elevation (in feet).
GC	GCA if available.
KA	Coordinates of airfield.
KB	Coordinates of beacon.
MA	Missed approach altitude (mean sea level and limits).
MW	Instrument minimums (absolute ceiling and nautical miles).
PL	Procedure turn to left.
PR	Procedure turn to right.
ZC	Restricted areas (coordinates of center and critical boundary terrain features).
RA	Radio frequencies (beacon, tower, and radar approach).
TW	Tower.
RF	Zone, control (coordinates of center of zone with radius in nautical miles or coordinates of critical boundary terrain features).

b. ADF Letdown Pattern. The following is a standard approach diagram and code format (fig. 25) recommended for use throughout the field army. The value of bearings, altitudes, distances, and locations are letter coded.

c. Air Route Schematic Diagram. The following is a suggested schematic coded diagram (fig. 26) for standardization throughout

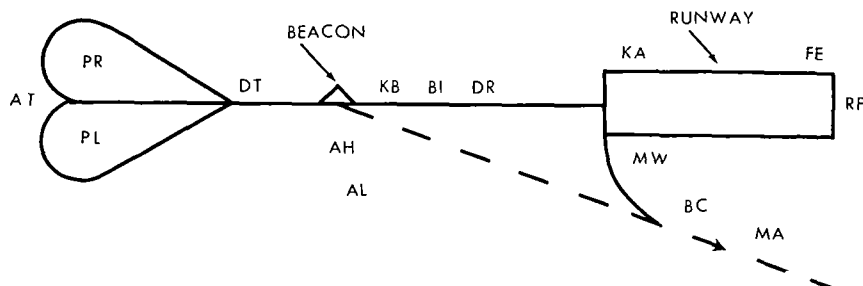


Figure 25. Standard approach diagram and code format.

the field army. The value of directions, locations, altitudes, and restricted areas are letter coded. Each beacon is labeled with its code letter group which, whenever possible, will begin with the first letter of the parent unit's combat code name.

8. Type Dissemination Messages

a. Coded text of type message concerning homing facility designated as MDD to read as follows:

"MDDKB350/148611 AH3050 AL2050 B1210 DR29 FE1450
AC/57.2/121.7/1136.4 TW/59.8/123.1/1123.6 KA123567
MA/3050/3-225 MW/30/2"

Clear text of above message:

MDD on 350 kc located at coord 148611. Hi cone 3050 MSL; low cone 2050 MSL; bearing inbound 210°; distance from facility to station 2.9 nautical miles; field elevation 1450 MSL; approach control radios, FM 57.2 mc, VHF 121.7 mc, UHF 1136.4 mc; tower radios, FM 59.8 mc, VHF 123.1 mc, UHF 1123.6 mc. Field coord 123-567. Missed approach: climb to 3050 MSL within 3 miles on bearing of 225° from MDD, instrument minimums 300 feet ceiling, 2 miles visibility.

b. Coded text of type message designating air route information concerning beacon with code designation of MKK:

"MKK CO 60 MOO CO 195 MSS CO 265 LAA DF 15 MOO
DF 60 MSS DF 45 LAA FE 1450 RF 350 GC KA 123567
KB 148611 RA 130601 Radius 02 miles ZC 123567 radius
03 miles"

Clear text of above message:

MKK course and distance outbound from MKK to MOO 60° 15 NM; MSS 195° 60 NM; LAA 265° 45 NM; field elevation 1450' (mean sea level); frequency of beacon 350 KC; coordinates of airfield 123-567; coordinates of beacon 148611; restricted area of 2 NM radius centered on coordinates 130601; control zone of 3 NM radius centered on airfield (coordinates 123-567).

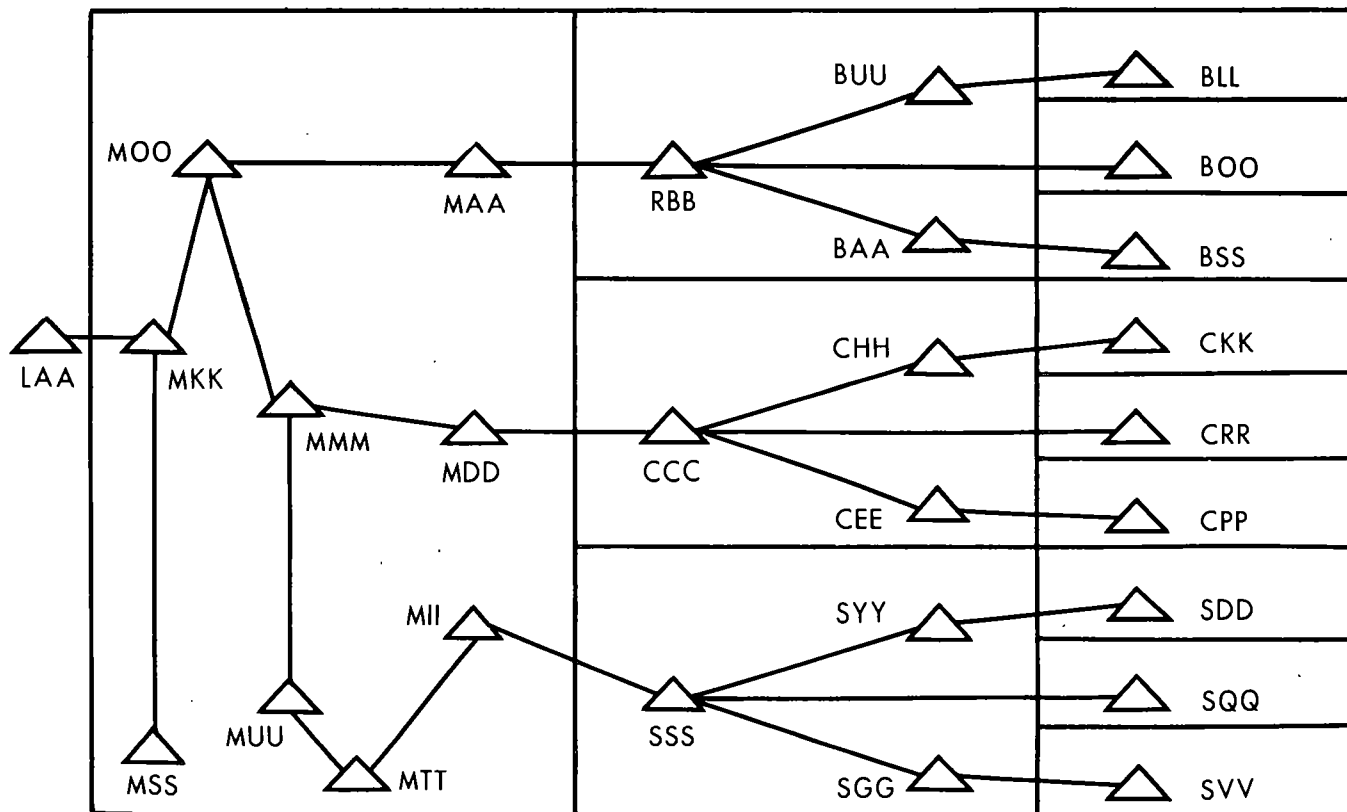


Figure 26. Air route schematic diagram and code.

APPENDIX III

OPERATIONAL CODES

Section I. GENERAL

1. General

ACP 165 establishes a uniform policy for the use of the operational brevity code as established by the Joint Communications-Electronics Committee of the United Kingdom and United States of America. The ACP contains 15 operational brevity codes and radiotelephone procedure prowords. **INDIVIDUALLY THESE WORDS HAVE NO SECURITY.** They are to be utilized, as appropriate, with plain language to permit concise and accurate transmissions. These codes are a compilation of a large number of words to satisfy any reasonable requirement, and to avoid the necessity for field forces having to improvise nonstandard code words for their own use. Although ACP 165 is classified, it is permissible to copy or make extracts which may be carried in aircraft (p. III, par. 3, ACP 165).

2. Use

Use of the operational brevity code will be restricted to emergency or lost aircraft procedures where security of the transmitted message is not of prime importance. All Army aviators should be familiar with this code and should be aware of the conditions under which it may be used.

Section II. OPERATIONS CODE

3. General

Codes or ciphers may not be used with the exception of operations codes, prearranged message codes, and converter or authorized map coordinate codes. Operations codes are used when other authorized cryptographic means are not available or practicable. Prearranged message codes are tactical codes adapted to the use of units such as the flight operations centers and aviation operating detachment (Army) which require special technical vocabularies.

4. Preparation

An Army aviation operations code may be prepared by the Army signal officer for use between FOC's and related airfields and Army aviation staff sections within the field army when other cryptographic means are not available or practicable. Since pre-

arranged message codes have no provisions for spelling, an operations code should be prepared for use within the field army or separate corps.

Section III. PREARRANGED MESSAGE CODES

5. General

Prearranged message codes for use in Army air traffic operations must be prepared in strict adherence to applicable standing signal instructions of the field army or separate corps. NO OTHER TYPE PREARRANGED MESSAGE CODE WILL BE USED UNLESS AUTHORIZED BY THEATER HEAD-QUARTERS.

a. The Army aviation special staff section at field army or separate corps will prepare its own prearranged message code when possible.

b. The code must be a two-part code; i.e., an encoding section and a decoding section.

c. The code should be kept as brief as possible, considering the requirements of the air traffic operations which will use it.

d. The code may include numbers if desired.

e. The code will not provide an alphabet section for the purpose of spelling.

6. Types of Prearranged Message Codes

Prearranged message codes are of two types, one-group messages and pattern messages.

a. A one-group message is a message which is fully expressed by a single code group.

<i>Example</i>		
<i>Code Group</i>	<i>Voice</i>	<i>Meaning</i>
AG	ALPHA GOLF	Request existing weather at your station.

b. A pattern message is composed of a code message group which requires additional information for completion, plus the additional code groups which are required to complete the message. Thus, the number of code groups required to complete a particular message forms a pattern.

<i>Example</i>		
<i>Code Group</i>	<i>Voice</i>	<i>Meaning</i>
RT	(Romeo Tango)	Ceiling and visibility at my station is _____.
CS	(Charlie Sierra)	500 (feet is referring to altitude or ceiling height).
WR	(Whiskey Romeo)	2 (miles if referring to visibility).

Complete example of transmissions :

“Groundhog (airfield) this is Bluejay (aircraft)
ABLE GOLF OVER”
“Bluejay this is Groundhog
ROMEO TANGO CHARLIE SIERRA
WHISKEY ROMEO OUT”

7. Use of Prearranged Message Codes

Use of prearranged message codes will be within the system needing the technical vocabulary. Since other cryptographic means are not practical for use in an Army aircraft, prearranged message codes will be used for the majority of Army air traffic tactical operations air-to-ground radio communications requiring security of message content. The phonetic alphabet will be used for voice transmissions. Mixing plain language or other codes, except authorized map coordinate codes, is prohibited.

APPENDIX IV

MAJOR ELECTRONIC EQUIPMENT

1. AN/GRN-6

a. Description. The AN/GRN-6 radio beacon is an item of ground equipment which transmits keyed, tone-modulated signals (type A-2 emission) and is used as a navigational homing and approach aid (fig. 13).

- (1) This set can be tuned continuously to any frequency from 190 to 500 kilocycles. Maximum power is 375 watts. The power input requirement is less than 2 kilowatts at 115 volts, 60 cycles.
- (2) The AN/GRN-6, packaged in shelter S-144, weighs 1,550 pounds. The dimensions of the shelter are 6.3 feet long by 4.7 feet wide by 5.0 feet high. Power for this equipment is provided by Generator Set PU-322/G which consists of two generators, PE-75, one of which is the alternate, thus insuring continuous operation of the set during refueling and maintenance periods.
- (3) A truck, $\frac{3}{4}$ -ton, with trailer, transports the radio beacon in the shelter S-144, which can be permanently mounted on the trailer to eliminate the need of unloading and loading.

b. Capabilities. The AN/GRN-6 radio beacon—

- (1) Provides continuous tone modulated signals with intermittent transmission of three-letter character code identifier. This code can be changed in less than 15 minutes.
- (2) Can be voice modulated to provide ground-air communication.
- (3) Can be tuned to any frequency from 190 to 500 kilocycles.
- (4) Provides reliable operation up to a range of 50 miles.
- (5) Is compatible with low-frequency radio direction-finding equipment installed in Army aircraft.
- (6) Has provisions for remote control.
- (7) Has an overload recycling system which satisfactorily protects the equipment by automatically taking the set out of operation in the event it is recycled 5 times in any 10-minute period.
- (8) Is equipped with a standard power generator, PU-322/G, to supply power.
- (9) Is easily transported in a $\frac{3}{4}$ -ton trailer (including the S-144 shelter).
- (10) Is easily transported by helicopter (fig. 27).

- (11) Is adaptable to a variety of antenna configurations because of the variations possible in antenna loading.
- c. *Limitations.* The AN/GRN-6 radio beacon—
- (1) Is susceptible to jamming.
 - (2) Is susceptible to spoofing.
 - (3) Can be used by the enemy.
 - (4) Is susceptible to geographic and atmospheric interference.

2. AN/FPN-33

a. *Description.* The AN/FPN-33 radar is a lightweight portable radar set, designed to perform four functions: taxi control, height finding, surveillance, and precision approach. However, this radar is not capable of simultaneous surveillance and precision approach operation. Physically, the set consists of two major equipment groups—the transmitter receiver-antenna group (fig. 28), and the indicator group (fig. 29). The entire system is controlled by a single operator located at the indicator. The transmitter equipment must be located at a suitable site near the runways. The indicator may be located in any area suitable for operation (normally 500 feet or less from the transmitter because of the length of the cable issued with the set) up to a maximum of 10,000 feet.

b. *Operation.* Since landing approaches are dependent on wind and runway alinement, the whole antenna system of the AN/FPN-33 is designed to rotate 385°, thus permitting use of the height-finding and approach modes of operation in any direction desired. Figure 30 illustrates the antenna actions as well as the four modes of operation.



Figure 27. AN/GRN-6 (in shelter S-144) as an external load on H-21C helicopter.

c. *Capabilities.* The set is capable of complete operation from the indicator group. Alinements and adjustments at the transmitter are simple and stable, requiring a minimum of maintenance. The entire system operates with a single transmitter and receiver. A general summation of the capabilities of the AN/FPN-33 is as follows:

- (1) Of relatively light weight (4,020 pounds), it is transportable on a 2½-ton truck with trailer, air transportable by helicopter, or preferably mounted on a generator trailer.
- (2) Power is supplied by a standard generator set, 10 kilowatts.
- (3) It is easily remoted.
- (4) It offers four functions (fig. 30).

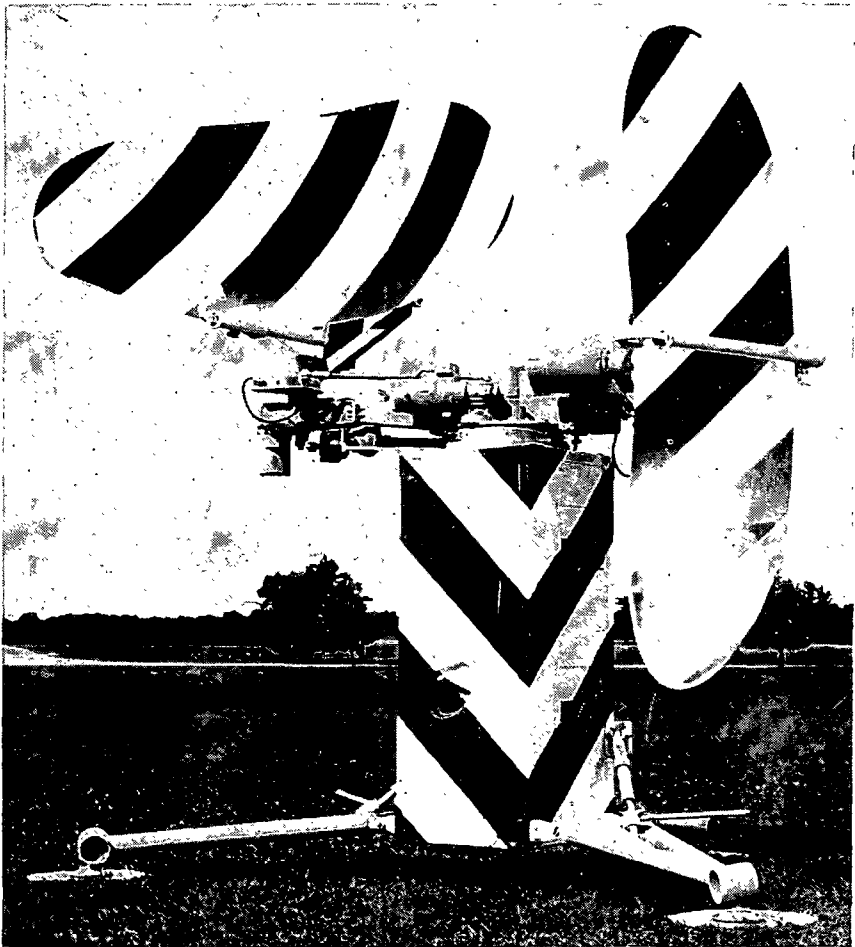


Figure 28. AN/FPN-33 transmitter equipment.

- (5) It provides five selectable ranges (1, 5, 10, 20, and 40 miles).
- (6) The airport taxi feature used in conjunction with the azimuth precision radar provides an expanded final approach picture of one mile, which offers excellent control and a high accuracy potential (dependent upon operator skill) in landing aircraft.
- (7) It provides adequate control radar for the local area.

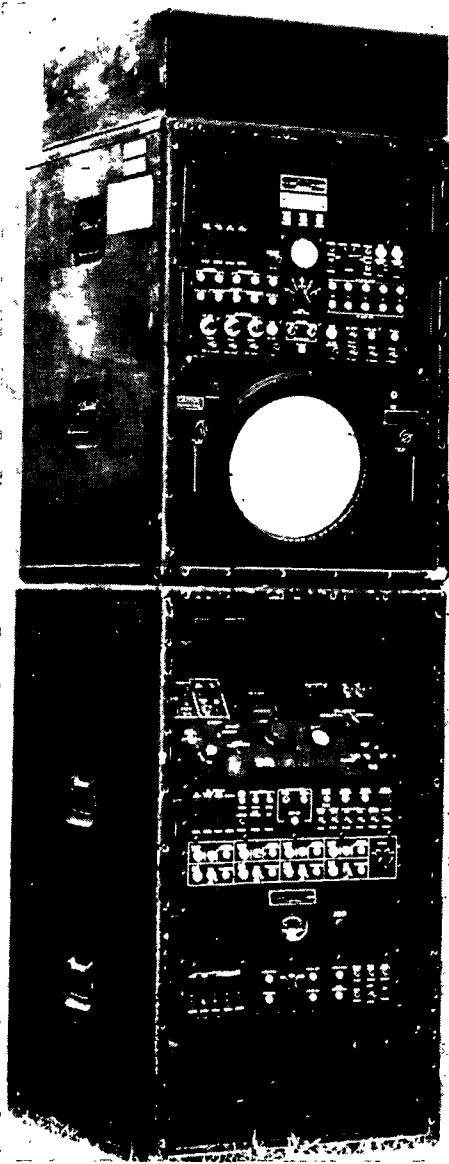
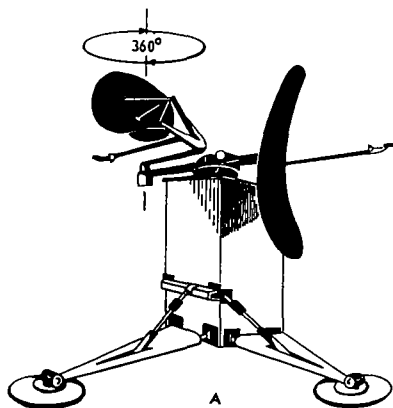


Figure 29. AN/FPN-33 indicator equipment.

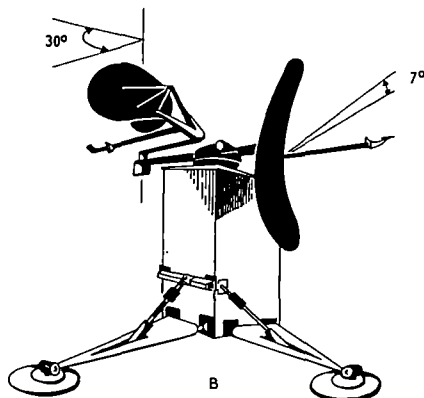
- (8) The minimum selectable ranges of 1 and 5 miles provide an expanded radar presentation for excellent tracking and vectoring.



ACTION DURING SURVEILLANCE OPERATION FOR AREA TRAFFIC CONTROL AND/OR AIRFIELD TAXI CONTROL.

AZIMUTH ANTENNA ROTATES 360° AT 15 r.p.m.

ELEVATION ANTENNA IS NOT USED.

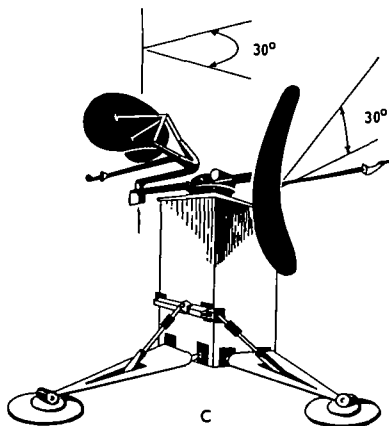


ACTION DURING PRECISION APPROACH OPERATION.

AZIMUTH ANTENNA SCANS A 30° SECTOR

ELEVATION ANTENNA SCANS A 7° VERTICAL SECTOR.

ANTENNA ASSEMBLY CAN BE ADJUSTED FOR THE VARIOUS LANDING DIRECTIONS BY MOVEMENT AS SHOWN IN DRAWING D BELOW

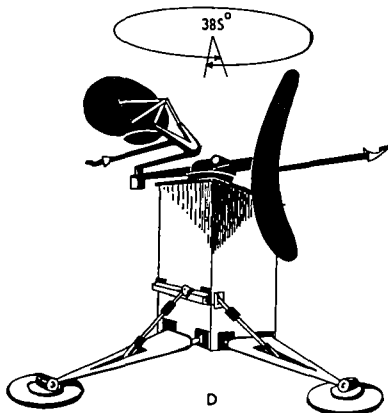


ACTION DURING HEIGHT FINDING OPERATION.

AZIMUTH ANTENNA SCANS 30° SECTOR.

ELEVATION ANTENNA SCANS A 30° VERTICAL SECTOR.

ANTENNA ASSEMBLY CAN BE ALIGNED TO SECTORS OF INTEREST BY MOVEMENT AS SHOWN IN DRAWING D TO THE RIGHT.



ANTENNA ASSEMBLY MOVEMENTS FOR ALIGNMENT TO VARIOUS RUNWAYS FOR PRECISION APPROACHES OR FOR ALIGNMENT IN SECTORS OF INTEREST FOR EITHER AIRCRAFT HEIGHT FINDING OR TO TRACK IN AZIMUTH.

ENTIRE ANTENNA ASSEMBLY CONTROLLED TO MOVE 385° IN EITHER DIRECTION AT A RATE OF 12° PER SECOND.

Figure 30. AN/FPN-33 antenna action and four modes of operation.

- (9) The 20-mile range insures coverage of navigational aids in the area to aid in identifying aircraft that are tracking inbound or outbound from the navigational aids.
- (10) When trailer-mounted (figs. 31 and 32), emplacement time is approximately 30 minutes.

d. Limitations.

- (1) The set can perform only one function at any given time.
- (2) Separate frequencies are required when two sets are used for simultaneous functions.
- (3) Reflectors must be located in the clear at fixed distances from the center line of the runway.
- (4) The set has no MTI (moving target indication).
- (5) The pedestal cannot be man-handled due to weight.
- (6) Jamming susceptibility (characteristic applies to all radar sets).

3. AN/ARA-31

a. Description. The AN/ARA-31 homing adapter is designed for use with the AN/ARC-44 radio set. It consists of directional aircraft antenna array and a switching device (figs. 33 and 34).

b. Aural Presentation. Aural presentation (fig. 35) by the homing adapter is as follows: The international morse code letter D is heard when the transmitting station is between 10° and 170° to the left of the aircraft; the code letter U is heard when the trans-

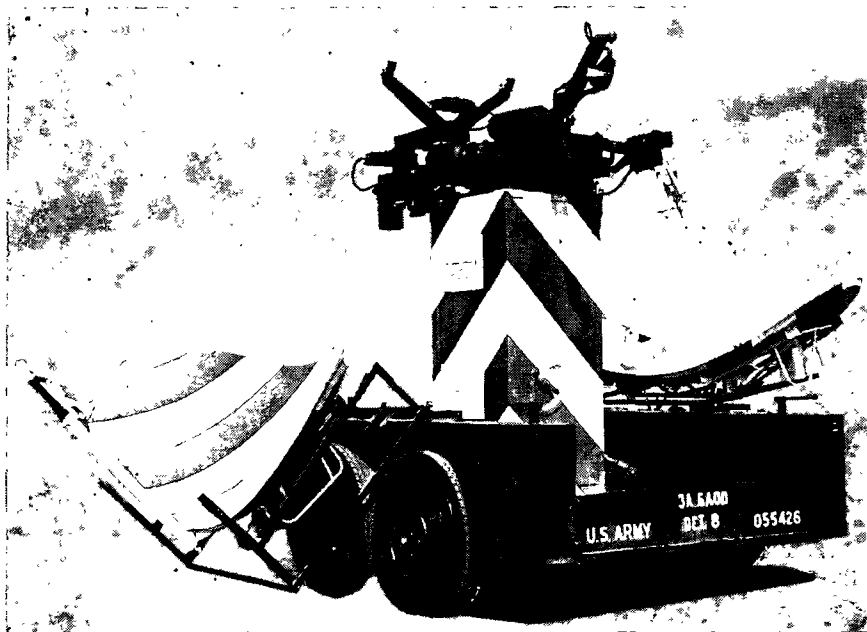


Figure 31. AN/FPN-33 loaded for movement.

mitting station is between 10° and 170° to the right of the aircraft; a continuous tone is heard when the aircraft is headed toward the station within plus or minus 10° . Tracking outbound from the station is also indicated by a continuous tone within plus or minus 10° . Homing may be accomplished on signals from ground or airborne transmitters.

c. Capabilities.

- (1) Offers adequate accuracy and reliability over level or mountainous terrain.
- (2) Can home on any FM radio.

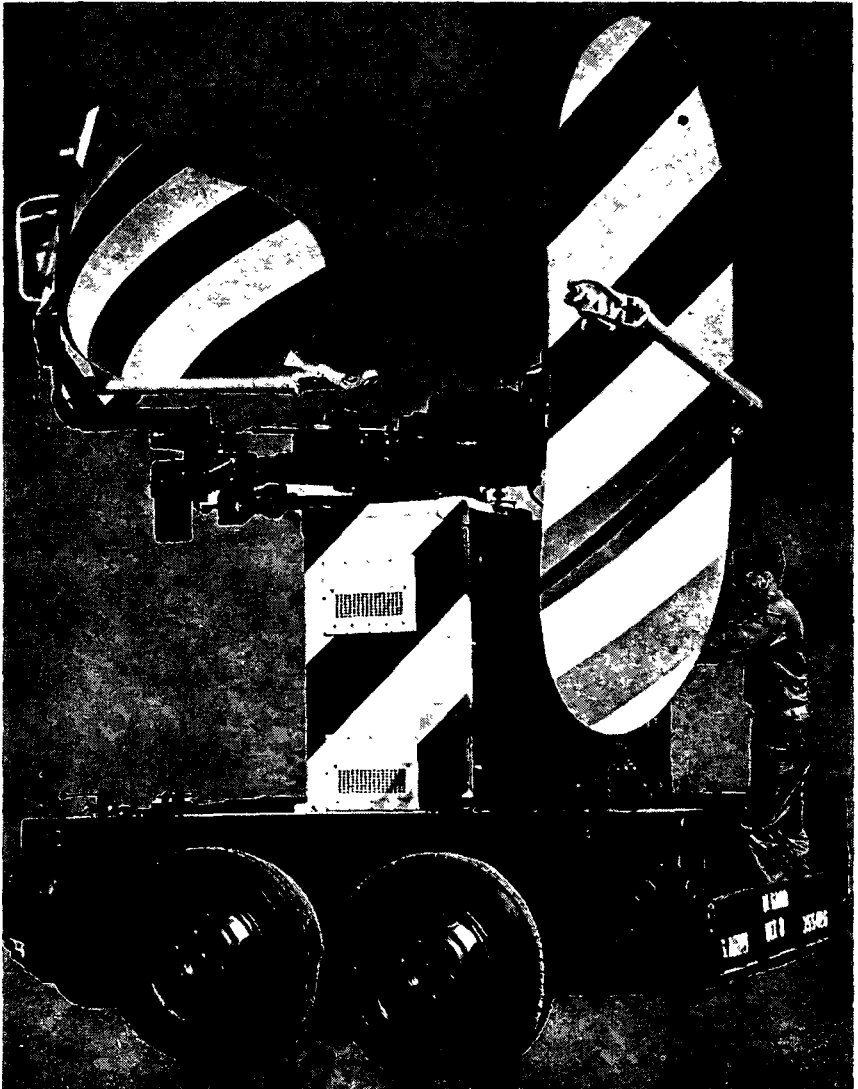


Figure 32. AN/FPN-33 transmitter in operational status.

- (3) Can be used by both fixed and rotary wing aircraft.
- (4) Is capable of ranges up to 40 miles, dependent upon weather and output of radios used as homing source.

d. Limitations.

- (1) The set is susceptible to jamming.
- (2) It can be used by the enemy (homing signal).
- (3) Range will fluctuate with geographic and atmospheric conditions.
- (4) Station passage indication is not obtained immediately; however, the sense of the homing signals will present this indication within a minute of passage.



Figure 33. AN/ARA-31 dipole antenna installed on L-19 aircraft.

- (5) Two or more stations within close proximity and operating on the same frequency will cause background noise. (The set will respond to the strongest signal received.)
- (6) The AN/ARA-31 cannot be used on all Army aircraft because of wide variation in electronic design requirements.

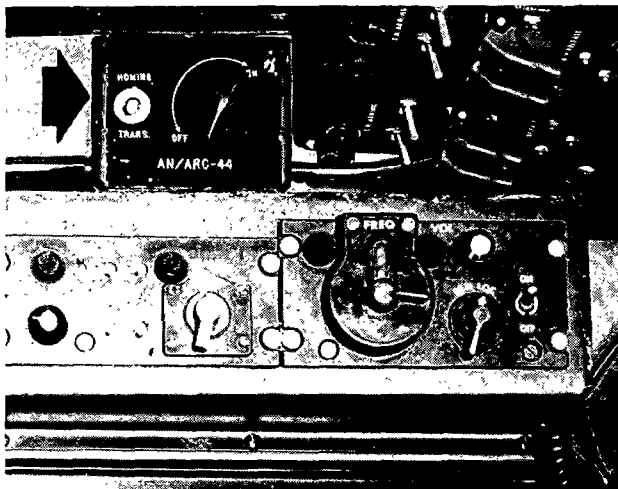


Figure 34. AN/ARA-31 "home-command" control switch mounted in L-19 aircraft.

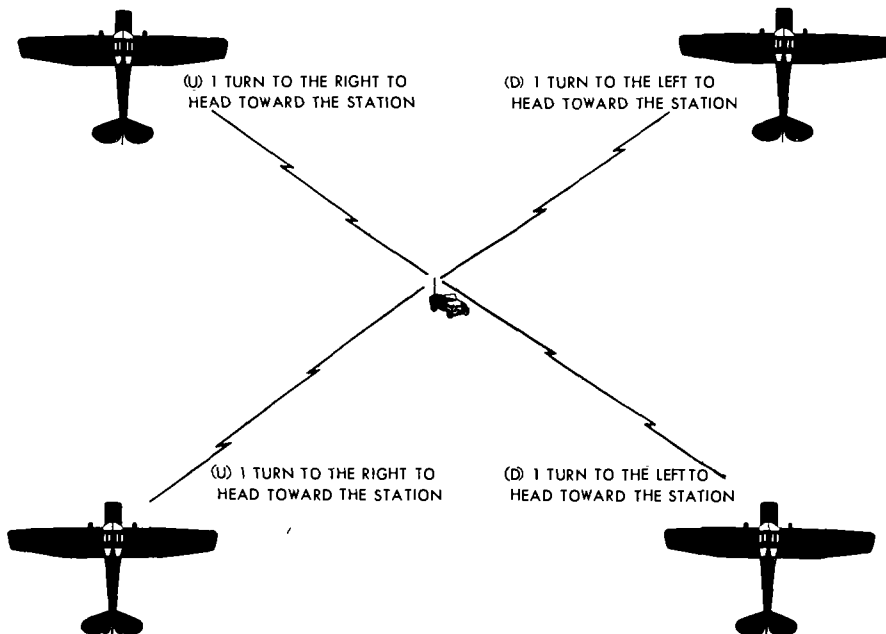


Figure 35. AN/ARA-31 aural presentation.

APPENDIX V

FIELD ARMY TACTICAL AIR TRAFFIC REGULATION PROCEDURES (FOC AND AIRFIELDS)

1. Responsibility

The procedures and practices contained herein outline standards for all facilities providing air traffic regulation services within the field army area. The flight operations control officer in the FOC and the air traffic supervisor in the airfield control tower will be directly responsible for conduct of operations within the facility involved. All air traffic regulation activities will be conducted in accordance with Army regulations and other pertinent directives published by appropriate authority. Deviations from prescribed standard procedures and practices will be permitted only upon written authorization as contained in unit SOP's or appropriate directives.

a. FOCO's and air traffic supervisors will be constantly alert to correct malpractice in established procedures and will actively prevent the habitual practice of any improper standard within the facility. Particular emphasis will be placed on the use of standard phraseology, the use and application of separation standards, accuracy in computing and using estimates, accuracy in completing forms, and adeptness of personnel in maintaining complete data pertaining to flights.

b. Periodic checks of operational effectiveness of each operator will be conducted and discrepancies immediately corrected.

c. Each installation will maintain a daily operations reading file to include current information contained in NOTAMS, field conditions, operating condition or malfunctions of equipment, unusual traffic conditions (i.e., airborne operations, mass flight), temporary procedure changes, restricted areas, and other conditions affecting the operation of the facility. This file will be reviewed continuously to insure that it contains only current information.

2. Shift Routine

When reporting for duty, all personnel will—

a. Inspect the daily operations reading file and the facilities status board.

b. Obtain latest weather information.

c. Spend sufficient time with the controller on the preceding relief to become completely familiar with existing traffic conditions.

3. Completed Duty Routine

Before being relieved from duty, the controller will—

- a. Check all forms, logs, and charts for accuracy of information.
- b. Brief relieving controller on current conditions to insure his complete familiarization with the situation.

4. General Traffic Regulation Procedures

Procedures which follow specify the use of a single flight strip—on the basis that the number of reports received by the controller in a particular FOC makes the single-strip method preferable. If air traffic in the FOC area of responsibility is excessive, the flight operations control officer may prescribe use of the multiple-strip method, which requires a flight strip for each fix involved.

- a. A proposed flight plan filed at airfield operations is transmitted both to the airfield tower and to the FOC. Flight plan information received by FOC is recorded on duplicate flight progress strips by the assistant controller. One strip is kept in a suspense file at the assistant controller position; the other is placed above the fix designator representing the point of departure at the controller position. The controller analyzes the flight plan and pays strict attention to existing traffic at point of departure and along proposed route of flight. If the flight plan route enters another regulation area, the controller obtains clearance to the destination airfield by coordinating with other FOC's concerned.

- b. The assistant controller prepares a strip which includes reporting points along the proposed flight route, and computes ETA's over each point, utilizing the time indicated on the pilot's proposed flight plan.

- c. When the flight is ready to depart, airfield operations notifies FOC and requests clearance. The controller issues the clearance by telephone through airfield operations or the airfield tower.

- d. Immediately after the flight departs, airfield control notifies FOC of the actual departure time. Time and point of departure are noted on the flight progress strip and the flight is again checked against other current flights to insure separation. The controller notifies control personnel at the destination airfield and other FOC's, if applicable, as to departure time and estimated time en route (ETE). Using actual departure time, the assistant controller computes new time estimates and enters these on the flight progress strip. The strip and strip holder are then moved into position under the next fix designator over which the aircraft will report.

- e. All flights will make position reports directly to the FOC when passing each compulsory reporting point. Data contained

in these position reports is entered on the flight progress strip(s) associated with the flight and forwarded to other FOC's when applicable. When necessary, the controller may issue revisions in flight clearance. These revisions are noted on appropriate flight progress strips by the controller and forwarded to other FOC's as necessary.

f. When a flight has reported over a fix, the flight progress strip and strip holder are moved to new position under the next fix designator.

g. As soon as possible after a flight has departed, the controller estimates the time when a flight will be cleared to airfield control. This information is forwarded to the destination airfield and to the flight concerned. This estimate is then revised in light of existing traffic and is disseminated as noted above.

h. When a flight has reported over its destination fix, the FOC controller issues appropriate instructions and clearance to allow the aircraft to descend to an altitude 1,000 feet above the top altitude controlled by the airfield tower.

i. Airfield tower personnel notify FOC when the top control altitude is vacant, and the FOC controller clears the flight to descend 1,000 feet and to contact the airfield tower for further clearance. The flight is controlled from this point by airfield tower personnel until it has landed. However, if the pilot has executed a missed approach with the intention to proceed to the alternate airport, or has been directed to exceed the block of airspace controlled by the tower to insure proper traffic separation, he is directed by the airfield controller to contact the FOC for further clearance, and tower personnel so notify the FOC controller. The FOC controller may clear the aircraft to re-enter the top of the stack or proceed to an alternate airfield, as necessary.

j. As soon as a flight lands at an airfield, airfield operations notifies the FOC. The FOC controller immediately relays this information to the airfield of departure and the monitoring FOC when applicable, and removes the pertinent flight progress strip from the control board.

5. Flight Progress Strips

a. Blue and buff-colored progress strips are used to indicate direction of flight. In areas where the direction of traffic is predominantly east and west, buff strips are used for flights proceeding in directions of 0° to 179° and blue strips for flights proceeding in directions of 180° to 359°. (For monitoring purposes, other colors such as light green and yellow may be used.) When the flow of traffic is predominantly north and south, this procedure may be modified. The flight operations control officer will determine

the method which, in his opinion, is the most convenient for the FOC.

b. Flight progress strips are arranged under fix designators. The strips are sequenced chronologically in order of arrival over the fix (time sequence).

- (1) Flight progress reports are posted directly on the appropriate flight progress strip.
- (2) Posting of calculations is accomplished as soon as possible after receipt of flight plans and flight progress reports, and in a manner that will least interfere with other positions of operation.
- (3) Data is posted on flight progress strips in black pencil. Red pencil may be used to indicate "landing" or "crossing air route" flights. Corrections and revisions are made by drawing a line through the incorrect figures and writing the correct figures in the same box. Erasures will not be made.
- (4) Listed below are items of information (numbered 1 to 17) to be included on a flight progress strip. Entries on this strip (fig. 36) are made according to this numerical key:
 - 1—Unit operations (code name).
 - 2—Aircraft identification.
 - 3—Type aircraft and radio (VHF, UHF, or FM).
 - 4—True airspeed.
 - 5—Estimated time en route and fuel on board, in hours.
 - 6—Proposed flight plan.
 - 7—Alternate airfield.
 - 8—Proposed takeoff time.
 - 9—Clearance (as approved by FOC).
 - 10—Actual takeoff time.
 - 11—Fix designator.
 - 12—Estimated time over fix designator.
 - 13—Actual time over fix designator.
 - 14—Altitude over fix designator.
 - 15—Time at which FOC releases flight to airfield control.
 - 16—Regulating data and/or expected approach clearance time; or, when preceded by the abbreviation FC, time when further clearance will be issued.
 - 17—Time of touchdown at destination.

6. Flight Departure and Arrival Strips

a. Airfield tower personnel will post data on flight arrivals and departures using blue and buff strips. Blue strips are used for arrivals and buff strips for departures. Exact methods of posting are determined by the air controller supervisor.

1.	6.	7.	8.	11.	12.	13.	14.	11.	12.	13.	14.	15.	17.
2.													
3.													
4.	9.		10.	11.	12.	13.	14.	11.	12.	13.	14.	16.	
5.													

Figure 36. Flight progress strip form.

b. Departure and arrival strips are arranged in the tower in a manner which will facilitate control. Strips will be sequenced chronologically in order of arrival or departure from the airfield.

- (1) As received from airfield operations, proposed flight plans are posted directly on a departure strip (buff).
- (2) Clearances for a flight are copied directly on a departure strip prepared for the flight.
- (3) Data is posted on departure and arrival strips in black pencil. Red pencil may be used to indicate missed approach or return to FOC control. Corrections and revisions are accomplished by drawing a line through incorrect figures and writing correct figures in same box.
- (4) As scheduled arrivals are received from FOC, they are noted on blue arrival strips.
- (5) Arrival strips are used to maintain constant track of all aircraft after FOC has cleared the flights to airfield control.
- (6) Listed below are items of information (numbered 1 to 11) to be included on arrival and departure strips at the airfield tower. Entries on these strips (fig. 37) are made according to this numerical key:
 - 1—Aircraft identification.
 - 2—Type aircraft/radios (UHF, VHF, FM).
 - 3—Destination (for departure only).
 - 4—Clearance information.
 - 5—Departure time or estimated arrival time.
 - 6, 7, 8—Altitude reports required by tower.
 - 9, 10, 11—Times at which pilot reports leaving the associated altitude.

1.	4.	5.
2.		6.
3.		7.
		8.
		9.
		10.
		11.

Figure 37. Departure and arrival strip form.

7. Posting Proposed Flight Plans in the FOC

a. The proposed flight plan is manually posted on a flight progress strip by the assistant controller at the FOC for the sector within which point of departure is located. This is done as soon as it is received over the operations telephone net from airfield operations or as soon as it is received from the aircraft after take-off. *Example* (fig. 38): Strip in Army FOC showing a proposed flight plan from MASTER (MMM) (Army airfield) to CHECKER (CRR) (a division airfield) by way of MURDER (MDD), CHOW- HOUND (CCC), and CHEWER (CEE). (As this flight progresses through the system, position reports will be forwarded to the adjacent FOC assigned the duty of monitoring this sector.)

b. A flight progress strip is immediately prepared with proposed flight plan data entered thereon.

- (1) This strip, with the proposed flight plan, is given to the senior controller for integration into existing and/or proposed air traffic.
- (2) The flight plan is then placed in the assistant controller's suspense rack for the departure point.

8. Posting Proposed Flight Plans in Airfield Tower of Origin

a. The proposed flight plan is manually posted on a departure strip by the assistant controller as it is received over the inter- phone from airfield operations. *Example* (fig. 39): Strip in Army airfield tower showing a flight plan for a flight originating at the Army airfield.

b. The departure strip is then posted on the departure rack.

9. Clearance for Departure

a. When the flight is ready to depart, the pilot contacts the tower by radio and requests clearance. He identifies the flight to the tower by reference to aircraft identification and/or call sign.

1 BLUEBIRD	6.	7	8	11.	12.	13.	14.	11.	12.	13.	14.	15.	17
2 R-12345	40-MMM-MDD	CCC	1730										
3 L20/VHF	CCC-CEE-CRR												
4 T-110	9.		10.	11.	12.	13.	14.	11.	12.	13.	14.	16.	
5 1+10/4+00													

Figure 38. Use of the flight progress strip, step 1.

b. The tower contacts FOC by direct telephone as soon as possible thereafter and requests flight clearance. Reference is made to the aircraft identification number as the aircraft call sign. This request is made to the assistant controller at FOC.

c. Upon receipt of clearance request at FOC, the controller refers to the flight progress strips representing other proposed flight plans. He identifies the clearance request by aircraft number or flight call sign. Elements of the flight are noted. Analysis is then made of information entered on flight progress strips in the racks of the traffic console representing point of departure and reporting points along the proposed flight route. This is done to determine present and future position of air traffic already in flight and the effect of subsequent departing flights on this traffic, so that appropriate regulating instructions may be issued.

d. If the flight plan involves a flight into another FOC area or if it is being monitored by an adjacent FOC, the controller effects direct coordination with the controller of the appropriate center. This is accomplished by use of the FOC telephone net and is primarily for verifying previous clearance coordination of the flight.

e. The controller issues a clearance to the airfield operations which requested the clearance. For relay to pilot, clearance is transmitted from FOC to airfield operations via direct telephone circuit. Reference is made to the aircraft or flight identification to prevent relay of clearance to the wrong aircraft.

f. Examples of types of clearances used by FOC controllers are as follows:

- (1) A clearance from point of origin to destination airfield via route of flight specified in proposed flight plan.
- (2) A clearance from point of origin to destination airport, via an alternate route to that specified in proposed flight plan.
- (3) A clearance as in *a* or *b* above, but with a specified time of departure or with release time instructions applicable to control exercised by an airfield tower.
- (4) A clearance as in *a* or *b* above, but with a specific departure procedure indicated.
- (5) Information that a clearance cannot be issued until a specified time.

¹ BLUEBIRD/R12345	⁴	⁵		
² L20/VHF		⁶	⁷	⁸
³ CHECKER-CRR		⁹	¹⁰	¹¹

Figure 39. Use of the departure and arrival strip, step 1.

1 BLUEBIRD	6 40-MMM-MDD	7 CCC	8 1130	11	12	13	14	11	12	13	14	15	17
2 R-12345	CCC-CEE-CRR												
3 L20/VHF	9	10	11	12	13	14	11	12	13	14	16	V-CRR	
4 T-110	MMM-MDD-CCC-CEE												
5 1+10/4+00	CRR-M30												

Figure 40. Use of the flight progress strip, step 2.

g. A clearance is composed as follows :

(1) Prefix FOC—

(a) Clears, or

(b) Advises.

(2) Flight or aircraft identification (call sign or code name).

(3) Clearance, specifying clearance limit and route.

(4) Altitude and departure information.

(5) Any special information.

(6) Message delivery instructions and/or cancellation time.

(This information is for tower.)

h. As he issues it, the FOC controller enters that clearance data on the flight progress strip which represents the proposed flight plan. *Example* (fig. 40) : Strip in the Army FOC showing clearance instruction entered thereon. (In this case, altitude was changed from requested 4,000 to an approved lower altitude of 3,000 feet.)

i. Airfield tower controller records FOC controller's instructions while they are being received, using approved symbols, abbreviations, and fix designators. The tower normally copies this clearance on a departure strip already prepared for flight. *Example* (fig. 41) :

j. Airfield tower relays the FOC's clearance to the pilot—

(1) By radio if clearance is "via flight" plan route, or

(2) By telephone to a station at the end of the runway if the proposed plan is changed.

k. Airfield tower controller enters time departure on the departure strip for the flight. *Example* (fig. 42) : Strip in Army Air-

1 BLUEBIRD/R12345	4 CV-CRR M30	5		
2 L20/VHF		6	7	8
3 CHECKER-CRR		9	10	11

Figure 41. Use of the departure and arrival strip, step 2.

1. BLUEBIRD/R12345	4. CV-CRR M30	5. 1135		
2. L20/VHF		6. 20	7. 30	8.
3. CHECKER-CRR		9.	10.	11.

Figure 42. Use of the departure and arrival strip, step 3.

field Master (MMM) showing departure time and control required by tower.

l. Airfield tower personnel control the flight and provide required separation until the aircraft leaves the airfield control zone. At that time, the flight is instructed to establish radio contact with the appropriate FOC.

m. Departure time is immediately relayed to the FOC controller through airfield operations. Reference is made to the aircraft identification number or code name of the flight so that the controller may note departure time of each flight.

n. The FOC controller receiving actual time of departure enters this time, as it is received from airfield operations, directly on the flight progress strip which represents the proposed flight plan. The flight progress strip is then placed below the designator of the next fix and in time sequence with the flight progress strips representing other flights. *Example* (fig. 43): Strip in Army FOC showing departure time, assigned altitude and estimated time over MURDER (MDD) beacon.

o. Departure time is received simultaneously by the assistant controller and the controller, and is entered directly on the flight progress strip which was previously placed in the rack at the assistant's position.

p. If the flight enters another FOC sector or is being monitored by an adjacent FOC, the controller or his assistant notifies the appropriate FOC of departure time and estimated time of arrival over first reporting point in adjacent control area.

1. BLUEBIRD	6. 40-MMM-MDD	7. CCC	8. 1130	11. MDD	12. 1150	13.	14. 30	11. CEE	12.	13.	14.	15.	17.
2. R-12345	CCC-CEE-CRR												
3. L20/VHF	9. MMM-MDD-CCC-CEE	10. 1135	11. CCC	12.	13.	14.	11. CRR	12.	13.	14.	16. V-CRR		
4. T-110													
5. 1+10/4+00	CRR-M30												

Figure 43. Use of the flight progress strip, step 3.

1. BLUEBIRD	6. 40-MMM-MDD	7. CCC	8. 1130	11. MDD	12. 1150	13. 1151	14. 30	11. CEE	12.	13.	14.	15.	17.
2 R-12345	CCC-CEE-CRR												
3. L20/VHF	9.	10.	11.	12.	13.	14.	11.	12.	13.	14.	16.	V-CRR	
4. T-110	MMM-MDD-CCC-EEE	10. 1135	11. CCC	12. 1211			11. CRR	12.	13.	14.			
5. 1+10/4+00	CRR-M30												

Figure 44. Use of the flight progress strip, step 4(1).

10. Preparation of Flight Data After Departure

a. The FOC assistant controller removes the strip and strip holder from its position under the fix designator as the flight reports over it, enters the actual time over designated fix, and moves strip and strip holder under the next designated fix along the route of flight. *Example* (fig. 44): Strip in Army FOC after flight passes MURDER (MDD) beacon.

b. If the flight originates outside this corps FOC control area, the flight progress strip will be prepared and inserted in the same manner, but will be placed in the rack under the first fix designator over which the flight will report in the area controlled by this FOC. *Example* (fig. 45): Strip in corps FOC showing flight from Army airfield MASTER (MMM) due to enter this corps FOC control area at CHOWHOUND (CCC).

c. The above information will be transmitted between FOC's by direct telephone.

11. Handling En Route Flight Data

All flights transmit position reports to the appropriate FOC when passing over each en route reporting point.

Note. When an aircraft departs a controlled airfield, the flight remains in communication with the tower until tower controller issues instructions to establish contact with FOC.

1. BLUEBIRD	6. 40-MMM-MDD	7. CCC	8. 1130	11. MDD	12. 1150	13. 1151	14. 30	11. CEE	12.	13.	14.	15.	17.
2 R-12345	CCC-CEE-CRR												
3. L20/VHF	9.	10.	11.	12.	13.	14.	11.	12.	13.	14.	16.	V-CRR	
4. T-110	MMM-MDD-CCC-CEE	10. 1135	11. CCC	12. 1211			11. CRR	12.	13.	14.			
5. 1+10/4+00	CRR-M30												

Figure 45. Use of the flight progress strip, step 4(2).

a. A position report consists of the following :

- (1) Aircraft identification (tactical call sign).
- (2) Position.
- (3) Time over position reported.
- (4) Indicated altitude.
- (5) Type of flight plan.
- (6) Estimated time over next reporting point (code).
- (7) Name of subsequent reporting point (code).

b. Position reports should be as brief as possible. *Example:* R 12345, MURDER, five one, three thousand, instrument flight, Rules, CHOWHOUND one one, CHEWER.

c. The air traffic controller refers to the flight progress strip representing the flight, as posted in rack on air traffic console.

d. Pertinent elements of a position report are entered in appropriate spaces of the flight progress strip as they are received via the air traffic regulation net direct from the pilot. *Example:* (fig. 46) : Strip in Army FOC showing position report and regulation data thereon for flight passing MURDER (MDD) beacon.

e. Pilot's estimate for the next reporting point on route of flight is entered in appropriate space of the flight progress strip posted in the rack for that reporting point. When next reporting point is in another FOC control area, pilot's position report over last fix in adjacent FOC is forwarded to controller thereof by controller who received position report. This is accomplished by direct telephone circuit between FOC's. *Example* (fig. V-12) : Strip in corps FOC showing time over MURDER (MDD) beacon and pilot's estimate for CHOWHOUND (CCC) beacon which is in this corps FOC control area.

f. Action outlined in b through d above is repeated at each reporting point on the flight route.

g. As amended clearances or instructions are issued to the flight, flight progress strips are marked accordingly by the FOC controller, using approved abbreviations and symbols (par. 13).

h. Examples of data entered when required by these reports are as follows :

1. BLUEBIRD	6. 40MMM-MDD	7. CCC	8. 130	11. MDD	12. 1150	13. 1151	14. 30	11. CEE	12.	13.	14.	15.	17.
2. R-12345	CCC-CEE-CRR	CCC	130	MDD	1150	1151	30	CEE					
3. L20/VHF	9. MMM-MDD-CCC-CEE	10. 1135	11. CCC	12. 1211	13.	14.	11. CRR	12.	13.	14.	16. V-CRR		
4. T-110													
5. 1+10/4+00	CRR-M30												

Figure 46. Use of the flight progress strip, step 4(3).

1. BLUEBIRD	6. 40-MMM-MDD	7. CCC	8. 1130	11. MDD	12. 1150	13. 1151	14. 30	11. CEE	12.	13.	14.	15.	17.
2. R-12345	CCC-CEE-CRR												
3. L20/VHF	9. MMM-MDD-CCC-CEE	10. 1135	11. CCC	12. 1211	13.	14.	11. CRR	12.	13.	14.	16. V-CRR		
4. T-110													
5. 1*10/4*00	CRR-M30												

Figure 47. Use of the flight progress strip, step 4(4).

- (1) Altitude levels vacated by aircraft during altitude change.
- (2) Time leaving a reporting point at which holding was accomplished.
- (3) Report at authorized altitude.
- (4) Time on course.

Example (fig. 48) : Strip in the course FOC showing time of passing CHOWHOUND (CCC) and estimated time over CHEWER (CEE) beacon. When flight reported over CHOWHOUND, air traffic controller issued an amended clearance assigning an altitude of 4,000 feet and requested a report of arriving at 4,000 feet.

i. After each position report has been posted on the flight progress strip, the controller compares the actual time over the reporting point with the estimate as posted by FOC. He then effects such revisions as are necessary to the estimates for subsequent reporting points in his zone.

j. If the pilot's estimate for the next reporting point differs from the FOC estimate by more than 3 minutes, the controller will contact the aircraft by radio and verify the pilot's estimate. If it is verified, controller advises pilot that control will be effected on basis of pilot's estimate for subsequent reporting points on the route of flight.

k. A revision of estimates is always accomplished by inserting the new estimate immediately below the old estimate, which is

1. BLUEBIRD	6. 40-MMM-MDD	7. CCC	8. 1130	11. MDD	12. 1150	13. 1151	14. 30	11. CEE	12. 1230	13.	14.	15.	17.
2. 12345	CCC-CEE-CRR												
3. L20/VHF	9. MMM-MDD-CCC-CEE	10. 1135	11. CCC	12. 1211	13. 1210	14. 1210	11. CRR	12.	13.	14.	16. V-CRR		
4. T-110													
5. 1*10/4*00	CRR- M30 M40 (1213)												

Figure 48. Use of the flight progress strip, step 5.

1. BLUEBIRD	6. 40-MMM-MDD	7. CCC	8. 1130	11. MDD	12. 1150	13. 1150	14. 30	11. CEE	12. 1235 1235	13.	14.	15.	17.
2. R-12345	CCC-CEE-CRR												
3. L20/VHF													
4. T-110	9. MMM-MDD-CCC-CEE	10. 1135	11. CCC	12. 1211	13. 1210	14. 1235 1235	11. CRR	12.	13.	14.	16. V-CRR		
5. 1*10/4*00	CRR- 1235 M40 (1213)												

Figure 49. Use of the flight progress strip, step 6.

deleted by drawing a line through it. *Example* (fig. 49): Strip in corps FOC showing a revised estimate at CHEWER (CEE) beacon.

l. If reported altitude is not the same as authorized altitude, controller contacts aircraft by radio and requests verification of reported altitude. Deviation from an authorized altitude is a violation of regulations except when required by an emergency condition.)

12. Handling Flight and Regulation Data at Destination

a. The air traffic controller in the destination FOC area of the flight calculates time at which the flight is expected to be cleared to airfield control (expected release time).

b. Expected release time is entered on the progress strip for the flight as soon as possible after the strip has been posted. *Example* (fig. 50): Strip in corps FOC for division airfield CHECKER (CRR), the point at which the airfield tower will assume control, showing expected approach time entered thereon.

c. Expected release time is kept current by revising the time as often as needed, based on rapidity of landings made by other flights at destination airfield.

d. Expected release time is communicated directly to the flight by the FOC controller as early as practicable after the flight enters the destination control area.

1. BLUEBIRD	6. 40-MMM-MDD	7. CCC	8. 1130	11. MDD	12. 1150	13. 1151	14. 30	11. CEE	12. 1235 1235	13. 1235	14. 40	15.	17.
2. R-12345	CCC-CEE-CRR												
3. L20/VHF													
4. T-110	9. MMM-MDD-CCC-CEE	10. 1135	11. CCC	12. 1211	13. 1210	14. 1235 1235	11. CRR	12. 1250	13. 1249	14. 40	16. V-CRR-1250		
5. 1*10/4*00	CRR- 1235 M40 (1213)												

Figure 50. Use of the flight progress strip, step 7.

e. If expected release time indicates the flight will be delayed 15 minutes or more and the flight has not entered the destination FOC control area, the expected release time is forwarded by telephone to the FOC controller in the operational area of the flight. This controller immediately notifies the pilot by radio of expected release time.

f. As soon as possible after an aircraft enters the destination area, the FOC controller in that area issues to the pilot, via radio, a clearance appropriate to the situation at the destination airfield.

g. Traffic and weather affect the clearance issued by the FOC responsible for traffic regulation over the point of destination. In checking these and other factors—

- (1) Is the destination airfield in the area of coverage of the FOC's 2-way radio equipment?
- (2) Will traffic and weather conditions permit the flight to proceed without delay with no holding required, or can a delay be expected?
- (3) Does destination airfield have an operating control tower or is it without facilities?
- (4) If a tower is in operation, does it use radar or standard beacon approach procedures?

h. In the case of this example flight, destination airfield is in the area of coverage of the corps FOC. It is served by a control tower using standard procedures, and is located in a control zone.

i. The corps FOC controller instructs the pilot to report directly to FOC, via radio, on arrival over the division airfield beacon.

j. The pilot reports his position over the division field beacon. At that time, the corps FOC controller clears the flight to hold at the division terminal beacon at a specified altitude and until further clearance is received. *Example* (fig. 51): Strip in corps FOC for division (CHECKER (CRR)) beacon.

k. The flight reports by radio directly to FOC that it has reached the newly assigned altitude. This information is reflected on the flight progress strip by drawing a line through the previous altitude.

1 BLUEBIRD	6	7	8	11	12	13	14	11	12	13	14	15	17
2 R-12345	40-MMM-MDD	CCC	1130	MDD	1150	1151	30	CEE	1235	1235	40		
3 L20/VHF	CCC-CEE-CRR												
4 T-110	9	10	11	12	13	14	11	12	13	14	16		
5 1+10/4'00	MMM-MDD-CCC-CEE	1135	CCC	1211	1210	38	CRR	1250	1249	48	H-CRR-1250		
	CRR-M30-M40					40				30	H-CRR-M30		
	(1213)												

Figure 51. Use of the flight progress strip, step 8.

1. BLUEBIRD	6. 40-MMM-MDD	7. CCC	8. 1130	11. MDD	12. 1150	13. 1151	14. 30	11. CEE	12. 1230 1235	13. 1235	14. 40	15. 1300	17.
2. R-12345	CCC-CEE-CRR												
3. L20/VHF	9. MMM-MDD-CCC-CEE	10. 1135	11. CCC	12. 1211	13. 1210	14. 40 40	11. CRR	12. 1250	13. 1249	14. 40 30	16. V-CRR-1250 H-CRR-M30		
4. T-110	CRR- M30 M40												
5. 1*10/4*00	(1213)												

Figure 52. Use of the flight progress strip, step 9.

l. As preceding aircraft vacate lower altitudes, the FOC controller issues new altitude clearances until the aircraft reaches 1,000 feet above the altitude control limit of the airfield tower.

m. When an aircraft is cleared to land by airfield control and the top control altitude is vacated, the tower controller notifies FOC by direct telephone circuit.

n. When notified that the aircraft has vacated the top altitude, the FOC controller clears the flight to descend to that altitude and to contact airfield control for further clearance. *Example*: (fig. 52): Strip in corps FOC showing aircraft has been released to division airfield control.

o. Immediately after aircraft is released to airfield control, the FOC controller notifies the airfield controller of the fact via direct telephone.

p. Immediately after being cleared to contact airfield control, the pilot changes to appropriate frequency and establishes contact with the airfield control tower.

q. After the flight terminates and time of landing is forwarded by the control tower to FOC, the final entry is made on the flight progress strip and it is removed from the flight strip holder and filed. *Example* (fig. 53): Strip in corps FOC with completed flight data entered.

1. BLUEBIRD	6. 40-MMM-MDD	7. CCC	8. 1130	11. MDD	12. 1150	13. 1151	14. 30	11. CEE	12. 1230 1235	13. 1235	14. 40	15. 1300	17. 1310
2. R-12345	CCC-CEE-CRR												
3. L20/VHF	9. MMM-MDD-CCC-CEE	10. 1135	11. CCC	12. 1211	13. 1210	14. 40 40	11. CRR	12. 1250	13. 1249	14. 40 30	16. V-CRR-1250 H-CRR-M30		
4. T-110	CRR- M30 M40												
5. 1*10/4*00	(1213)												

Figure 53. Use of the flight progress strip, step 10.

13. Abbreviations and Symbols

a. *Aircraft.* The following abbreviations are authorized for use in indicating aircraft for flight identification :

- E—Air Evacuation Flight
- A—Air Force
- M—Military Air Transport Service
- R—Army
- V—Navy

b. *Clearances.* The following abbreviations are approved for use on flight progress strips to indicate clearance status of a flight at a specified fix (or reporting point) :

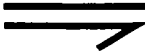
- A—Cleared to airport (point of intended landing).
- B—Air route clearance delivered (towers and approach control only).
- C—Cleared to the center frequency.
- D—Cleared to depart from the fix.
- F—Cleared to the fix.
- G—Cleared to ground controlled approach.
- H—Holding instruction issued.
- L—Cleared to land (towers and approach control only).
- N—Clearance not delivered.
- P—Cleared to enter traffic pattern (tower and approach control only).
- Q—Cleared to fly (-----) courses/quadrants within radius of (-----) miles from station.
- T—Cleared through (for landing and takeoff).
- V—Cleared over the fix.
- X—Cleared to cross air route in vicinity of fix.
- Z—Cleared to the tower.

c. *Holding Instructions.* When original clearance contains holding instructions, abbreviations such as F need not be used with abbreviation H. Abbreviation H will be followed by a dash (—) and an abbreviation indicating direction from fix on which aircraft has been instructed to hold whenever holding differs from established direction for a particular beacon; *example:* H-E, H-NE, etc.

d. *Clearance Limit.* Clearance limit will, when appropriate, be followed by a dash (—) and abbreviation Z, to indicate that aircraft is released to tower or approach control jurisdiction; *example:* G-Z, H-NE-Z, etc. Where appropriate, abbreviations V, F, H, etc., will be followed by a dash (—) and abbreviation C, to indicate point at which an aircraft will establish radio contact with FOC; *example:* F-C, R-C, etc.

e. *Control Symbols.* The following most generally used symbols and combinations of symbols and abbreviations are approved for manual recording or indicating control information, traffic clear-

ances, or flight movement messages. Plain language, authorized abbreviations, or contractions may be used to supplement the symbols so that any written message may be read and understood by facility personnel. Unauthorized abbreviations, phrase contractions, or symbols will not be used.

SYMBOL	INDICATION
 (Altitude)	Climb to (altitude) immediately.
 (Altitude) (Time) (Fix)	Climb to (altitude) at (time); or, immediately after passing (fix).
 (Altitude)	Descend to (altitude) immediately.
 (Altitude) (Time) (Fix)	Descend to (altitude) at (time); or immediately after passing (fix).
 (Altitude)	Cruise.
@ (Time) (Altitude) (Fix)	At.
× (Altitude) (Fix) (Time)	Cross.
 (Altitude) (VFR)	Maintain.
ABV (Altitude)	Above.
BLO (Altitude)	Below.
OT	Remain above clouds, haze, smoke, or fog level.
Condition	
VFR or (Alternate instructions)	VFR: if not possible (alternate instructions) and advise.
RL (Altitude level(s))	Report immediately on leaving.
RR (Altitude level(s))	Report immediately on reaching.
C	FOC clears.
	Cross airways.
	Join airways.
	Enter control area.
	Out of control area.
	While in control area.

SYMBOL	INDICATION
	While on airways.
 (Time) (Fix)	Before.
 (Time) (Fix)	After.
T/O (Time) (Direction)	Take Off.
LT	Turn left after takeoff.
RT	Turn right after takeoff.
LS (Route)	Left side.
RS (Route)	Right side.
SYD (Aircraft NR)	Release subject your discretion with respect to (aircraft identification).
/ (Time)	Until.
()	Alternate instructions.
Restriction	Restriction.
 (Time)	Clearance void after.
VIFNO (Time)	Clearance void if aircraft not off ground by.
RFAC	Request further altitude changes en route.
TFC (Location)	Traffic is.
ADNL TFC (Location)	Additional traffic is.
RC	Reverse course.
UFA	Until further advised.
FC (Time)	Expect further clearance at.
EAC (Time)	Expect approach clearance at.
DLA INDFT or (Time)	Delay indefinite expect approach clearance not later than (time).
	Contact (name) center on (frequency).
	Contact (name) approach control on (frequency).
APC	Approach control.
CT	Contact approach.
ILS	ILS approach.
SR	Standard range approach.
SI	Straight-in approach.
ADF	ADF approach.

SYMBOL	INDICATION
GCA	GCA approach.
FM	Fan marker approach.
I	Initial approach.
F	Final approach.

MISCELLANEOUS SYMBOLS	INDICATION
	Information forwarded.
○	Aircraft has reported at altitude other than proposed altitude.
W (Red Marking)	Warning.

	VOR.
(Red Marking)	

A dash (—) may be used to indicate "From——— to ———," as "From St. Louis to Chicago" would be written STL-CHI or from "3,000 to 4,000" would be written "30-40." The following are examples which illustrate the use of symbols:

MARKING

50/FHN	Maintain 5,000' until reaching (fix).
VFR/5E	Maintain VFR until 5 minutes east.
50/1020E	Maintain 5,000' until (time).
5T 5T 5T 5T	Maintain 500' on top flight above
— or — or — or —	clouds, haze, smoke or fog.
⊕ H K F	
10 AF3996	Maintain 1,000' above or below Air
——— or ———	Force 3996.
AF3996 10	
@ 80 50	Maintain 8,000' descend to 5,000' at
———	1020E.
1020E	
70 30 70 30	Maintain 7,000' descend so as to reach
——— or ———	3,000' before (time) or (fix).
1020E FHN	
50 90	Climb VFR from 5,000' to 9,000'; if
———	not possible, maintain 5,000'.
VFR (50)	

14. Aircraft Plotting Board Procedure

a. As a flight plan is received in the FOC, the aircraft plotting board operator will monitor the call and prepare a magnetic flight

symbol to represent the flight. This symbol will display information as follows:

- (1) Altitude.
- (2) Type of aircraft (speed).
- (3) Direction of flight.
- (4) Radios available.
- (5) Flight reference number.

b. The prepared flight symbol will be placed in suspense until actual departure time has been received from the airfield.

c. When the actual departure time is received in the FOC, the plotting board operator will place the symbol on the plotting board at the point representing the point of departure, and transfer this information immediately to the AADCP.

d. As position reports are received in the FOC, the controller will move the flight progress strip representing the flight to the next fix. The movement of this flight progress strip indicates that the flight has arrived at the last fix, and will be the signal for the plotting board operator to move the flight symbol along its route of flight to the appropriate point on the map representing the latest reported position.

e. When directed by the flight operations control officer, the aircraft plotting board operator may move the flight symbols on a time schedule using computed groundspeed. This would permit plotting along the flight route between beacons.

f. When a flight is cleared for operation off air routes between beacons, the plotting board operator will plot the course directly on the plotting board, using a straight edge and a china marking pencil.

g. When a flight has been cleared to airfield control, the plotting board operator will remove the altitude indicator from the flight symbol, leaving the symbol itself at the destination fix until the airfield has reported the aircraft on the ground. In the event the flight has executed a missed approach, a new clearance will be issued by the FOC (when required), and the flight symbol will be adjusted and handled in accordance with the new clearance.

h. For purpose of identification, the aircraft plotting board operator will be required upon request to furnish the location of an aircraft between beacons. This will be accomplished by computing the groundspeed of the aircraft and time of the latest report over a known point. Map reference used for identification will be the Georef grid system as used in the AADCP, which is available as a pullover template on the aircraft plotting board.

i. In an emergency involving a lost aircraft, radar position data may be received through the AADCP. Upon receipt of this data, the plotting board operator will plot the reported position on the

plotting board and immediately compute a course and time to the airfield equipped with GCA equipment which is nearest to the plotted position. This course will be plotted on the map with a china marking pencil, and the symbol representing the flight will be moved along the directed route as prescribed for normal flights. Additional radar plots will be requested when necessary to correct for wind drift.

j. The aircraft plotting board operator has the additional duty of coordinating with the AADCP of all flight data necessary to maintain current position plots. This will be accomplished by direct interphone between the plotting board operator and the AADCP. Data transmitted will consist of immediate relay of flight plan data as symbols are prepared, and notification of changes as they occur on the plotting board.

15. Flow Control

a. The number of IFR flights proposed to operate in an FOC zone of responsibility may occasionally exceed the capacity of facilities for the safe handling of aircraft or flights may, for some tactical reason, be limited. When an FOC anticipates that flights may be appreciably delayed for the above reason, flow procedures will be placed in effect.

b. Under the above conditions, or in anticipation of these conditions, the flight operations control officer will formulate and issue a traffic operation estimate to airfields in his area and other FOC's. This estimate will include—

- (1) Any time delay expected on traffic at specific airfields or over specific routes or areas.
- (2) Alternate routes or airfields recommended.
- (3) Limitations, if any, on number of flights which will be cleared *into* the FOC area or specific airfield control area.
- (4) Expected time of return to normal operation.

c. Information contained in traffic operations estimates will be disseminated to all airfield operations and will be used as advisory data for pilots in flight planning.

d. The flight operations control officer will coordinate with all interested agencies when making up his traffic operations estimate. Some subjects to be considered in formulating the traffic estimate are as follows.

- (1) Weather conditions, actual and forecast.
- (2) Altitude levels available.
- (3) Routing of flights (alternates if available).
- (4) Type and rapidity of landing clearance in view of actual and forecast weather conditions.
- (5) Use of alternate airfields.

(6) Volume of proposed traffic.

(7) Time length of tactical restrictions, if any.

e. Dissemination of traffic operations estimates will be either by direct telephone circuit or teletypewriter. If flow procedures should become necessary on a recurring basis, estimates would be prepared on a time schedule. In any event, the procedures to be followed will be published in a standing operating procedure.

GLOSSARY

Air Corridor—A restricted route of air travel established for the purpose of preventing friendly aircraft from being fired upon by friendly forces.

Aircraft Traffic Console—A component of the FOC VAN used by air traffic controllers to display flight progress strips.

Air Defense Exclusion Areas—Those areas over which no aircraft are normally allowed to fly.

Airfield Traffic Control Zone—A zone established at Army airfields in the combat zone. Such zones include the area within a 3-mile radius of the airfield extending from the surface to a stated altitude, within which the airfield is responsible for the regulation of air traffic.

Air Route—A route (normally connecting airfields) established between LMF beacons for the purpose of expediting traffic flow and assisting in the air defense mission. *See also* Air corridor.

Air Traffic Regulation—A service operated by appropriate authority to promote the safe, orderly, and expeditious flow of air traffic.

AN/FPN-33—A ground controlled approach (GCA) radar set currently used by the Army.

AN/GRN-6—An LMF nondirectional beacon.

AN/TSW-1 (XC-2) (Air Traffic Control Set)—A terminal area air traffic control facility consisting of a visual shelter to serve as an airfield control tower and a radar shelter for the GCA operator. Both shelters are designed for transport on a 2½-ton truck and may be lifted by cargo type helicopters. The visual shelter contains all the required radio and telephone communications equipment, signalling equipment, and ancillary items. The radar shelter contains radio and telephone communications equipment and mounting space for remote indicator and control for the AN/FPN-33.

AN/TSW-3 () (Flight Operation Central)—An en route air traffic regulating facility consisting of necessary communications and control equipment.

Approach Control Team—A team operating GCA radar and related communications equipment designed to enable aircraft to land under restricted visibility conditions.

Army Air Defense Command Post (AADCP)—Tactical headquarters of the Army air defense commander, through which all elements of the air defense artillery are supervised.

Army Air Defense Information Service (AADIS)—An organized information service by means of which fire units of the air de-

fense command are kept informed of aerial activity. The service is established by air defense commanders and includes radars, observers, and necessary communication facilities.

Control and Reporting Center (CRC) (Air Force)—An agency which controls Air Force operations within an assigned geographical area. It has operational control of all activities of the Air Force aircraft control stations within its area of operation.

Direction-finding (D/F) Station—A ground-based direction-finding station which consists of radio receivers equipped with directional antennas. Direction-finding stations are capable of providing position and heading data to any aircraft transmitting a signal on the D/F frequency.

Fire Support Coordination Center (FSCC)—An agency through which the artillery commander coordinates the planning and initiation of fire support.

Flight Operations Center (FOC)—An agency of the aviation operating detachment (Army) established at corps and field army level adjacent to the AADCP and responsible for effecting Army air traffic regulation and identification operations of the command.

Flight Operations Center Officer (FOCO)—The duty officer responsible for the functioning of the flight operations center (FOC).

Flight Progress Strip—A strip of paper upon which is noted the data required to regulate air traffic within an FOC area of responsibility.

Forward Area—Normally that area of aircraft control bounded by the tactical boundaries including and forward of division rear boundaries.

Ground Controlled Approach (GCA)—An approach during which the aircraft is vectored by use of radar and radio communication.

Hold Fire—An Army air defense weapons status.

Identification (Aircraft)—The indication by any act or means of your own friendly character or individuality.

Identification Friend or Foe (IFF)—A system of electronic interrogation and reply (if friend) generally used in connection with radar for identifying aircraft, surface vessels or vehicles.

Instrument Flight Rules (IFR)—Conditions (rules) under which an aircraft is flown during conditions of poor visibility which do not permit flight under visual flight rules. (See VFR.)

Inter-area Flight—A flight that involves operation in two or more flight operations centers' areas of responsibility.

Light Line—A theoretical line on the ground beyond which aircraft proceeding to the front at night are prohibited from using navigation lights.

LMF Beacon System—A system which employs ground radios transmitting a coded LMF nondirectional signal upon which aircraft can navigate; it does not require line-of-sight between ground station and the aircraft.

MF/HF Radio—An amplitude modulated radio operating at a relatively low frequency. It is used for voice or CW ground-to-ground communication and usually has the capability of operating at longer ranges than a frequency modulated (VHF FM) radio by the same power output because of line-of-sight characteristics of the latter.

NOTAM—A notice-to-airmen report which relates to aircraft operation and air navigation. NOTAM's contain information concerning the establishment, conditions, or change of—

- (1) Aids to air navigation.
- (2) Airports or landing areas.
- (3) Hazards to air navigation.
- (4) Services, procedures, or regulatory requirements.

Recognition—The determination by any means of the friendly or enemy character, or the individuality, of another.

Scat Plan—A plan for clearing aircraft from a specific area, usually implemented through the use of radio transmitter code words to identify the area in question and the portion of plan to be executed. This plan is published by the senior commander concerned.

Spoofing—A deceptive radio signal transmitted by the enemy to mislead a pilot. An example is a deceptive beacon identification that may guide a pilot to a decoy beacon in enemy territory.

Subarea 1—That portion of the field army area forward of the FEBA to the maximum effective range of Army air defense missiles.

Subarea 2—That portion of the field army area between the FEBA and the division rear boundary.

Subarea 3—That portion of the field army area between the division rear boundary and the field army rear boundary, which may extend into the communication zone when necessary.

Traffic Pattern—The flow of aircraft operating on and in the vicinity of an airport. (Direction of flow is normally determined by wind direction.)

Visual Flight Rules (VFR)—Rules governing flight conducted under visual flight conditions. (See IFR.)

Weapons Free—An Army air defense weapons control status.

Weapons Tight—An Army air defense weapons control status.

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For explanation of abbreviations used, see AR 320-50.

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22

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